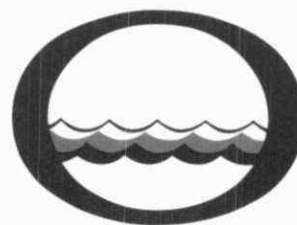


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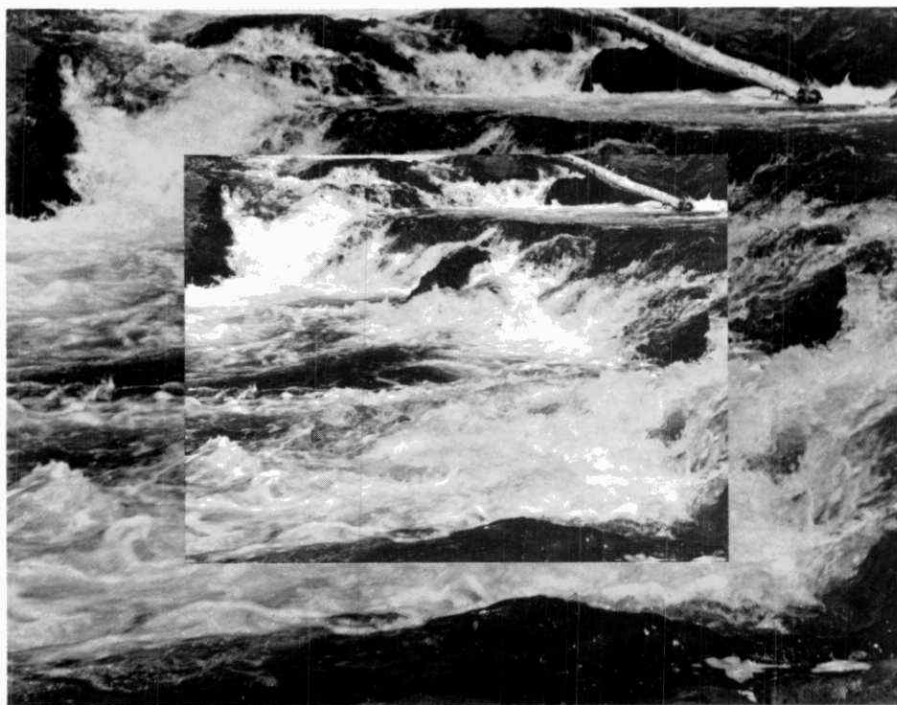
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Water management in Ontario



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ontario water resources commission

13TH ANNUAL REPORT



ONTARIO WATER RESOURCES COMMISSION
OFFICE OF THE CHAIRMAN

April 1, 1969

To: The Honourable J. R. Simonett,
Minister of Energy and Resources
Management.

Sir:

In conformity with and under the provisions of The Ontario Water Resources Commission Act, I have the honour to present to you the Thirteenth Annual Report of the Ontario Water Resources Commission.

The Report covers the activities of the Commission during the year 1968 under the Chairmanship of Dr. J. A. Vance who retired March 31, 1969.

Respectfully submitted,

J. R. Simonett
Chairman.



ONTARIO WATER RESOURCES COMMISSION
OFFICE OF THE GENERAL MANAGER

April 1, 1969.

Mr. D. J. Collins,
Chairman,
Ontario Water Resources Commission,
135 St. Clair Avenue West,
Toronto 7, Ontario.

Dear Mr. Collins:

It is with pleasure that I present to you and the other members of the Ontario Water Resources Commission the Thirteenth Annual Report of the Commission.

Yours Sincerely,

D. J. Collins
General Manager.



Dr. J. A. Vance *Chairman*
J. H. H. Root *Vice-Chairman*

Commissioners

H. E. Brown
D. A. Moodie
L. E. Venchiarutti,
W. S. MacDonnell *Commission Secretary*

STAFF ORGANIZATION AS OF DECEMBER 31, 1968

General Manager D. S. Caverly
Assistant General Managers L. E. Owers, K. H. Sharpe,
F. A. Voegel, A. K. Watt
Assistant to the General Manager M. J. Cathcart

ADMINISTRATIVE BRANCHES

Public Relations and Information: Director M. F. Cheetham
Legal: Senior Solicitor H. Landis
Personnel: Director A. R. W. Uren

DIVISION OF ADMINISTRATIVE SERVICES

L. M. Tobias *Director*

DIVISION OF CONSTRUCTION

A. W. Shattuck *Director* J. C. F. MacDonald *Assistant Director*

DIVISION OF FINANCE

E. F. Heath *Comptroller and Director*

DIVISION OF INDUSTRIAL WASTES

D. P. Caplice *Director* H. A. Clarke *Assistant Director*

DIVISION OF LABORATORIES

J. H. Neil *Director*

DIVISION OF PLANT OPERATIONS

D. A. McTavish *Director* C. W. Perry *Assistant Director*

DIVISION OF PROJECT DEVELOPMENT

P. G. Cockburn *Director* L. F. Pitura *Assistant Director*

DIVISION OF RESEARCH

A. J. Harris *Director*

DIVISION OF SANITARY ENGINEERING

J. R. Barr *Director* G. R. Trewin *Assistant Director*

DIVISION OF WATER RESOURCES

K. E. Symons *Director* D. N. Jeffs *Assistant Director*

MOE

STANDARDS DEVELOPMENT BRANCH

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Introduction

The responsibility of the Ontario Water Resources Commission continued to move forward in 1968 in the field of water resources management. The material contained within this Annual Report outlines the various activities in which it has been engaged.

Most of the Commission's activities during the past year centered around the expansion of existing programs. This expansion was particularly noticeable in the Commission's development of water supply and sewage treatment facilities. While a large number of municipalities continued to develop projects through their own financing, there was a marked increase during the year in the number of projects undertaken by the Commission in agreement with municipalities, particularly on the basis of Provincial ownership.

The Provincial Ownership Scheme introduced in 1964/1965 reached a notable level of achievement in the year with the signing of the South Peel County Agreement. On December 17, 1968, the official signing of agreements between five South Peel County municipalities and the Ontario Water Resources Commission cleared the way for the development of an extensive water supply and sewerage system which, it is expected, will cost some \$88 million over the next 20 years. This scheme, which is the largest undertaken by the OWRC to date, will be financed by the Province. Ownership will remain vested in the Province and the participating municipalities will pay for the water supply and sewage treatment services based on the actual cost to the Province.

Other regional schemes which likewise will have far-reaching effects upon the economic and social growth of entire areas are being developed in other parts of the Province as well. The task of co-ordinating and implementing these proposals (some of which involve a number of municipalities) is indeed

a challenging one.

As an indication of the extent of the programs of construction being carried out in the Province as a whole (including those undertaken by municipalities as well as those being developed by the OWRC) the total value of water and sewage works approved by the OWRC in 1968 exceeded, for the first time in the Commission's history, the \$200 million mark.

The Commission's Great Lakes Water Quality Survey, initiated in 1965, continued. The results of these investigations, pertaining to the international pollution problems of the Great Lakes and their connecting channels, were incorporated with information from other Canadian and United States agencies into a joint report which will be submitted to the International Joint Commission in 1969.

The river basin planning studies, which commenced in 1967 on the Grand and Ottawa rivers, were further developed during the year. These projects are designed to examine the major factors affecting water quality and use in the basins. Studies were also carried out on the Avon River below Stratford, Uxbridge Brook at Uxbridge, the Credit River below Orangeville, and the Wabigoon River at Dryden.

The water quality monitoring program designed to provide monthly, seasonal and annual variations in water quality was intensified, with samples being collected from 290 streams at 563 locations. The use of robot monitoring stations was expanded.

Emphasis was placed during the year on regional services planning. In co-operation with other government agencies and departments, progress was made in defining the problems related to the development of areas on a regional basis with a view to producing the most reasonable schemes based on social, economic and engineering considerations.

Considerable progress has been made by the

Commission in the area of industrial waste pollution abatement. As most plants have effected a degree of effluent control, or have established programs to do so, emphasis is now being placed by the Commission on the surveillance and evaluation of industrial waste treatment works with a view to checking treated effluent conditions against OWRC objectives. Certain industrial waste problems yet remain to be corrected, however, and these are receiving the full attention of the Commission at the present time.

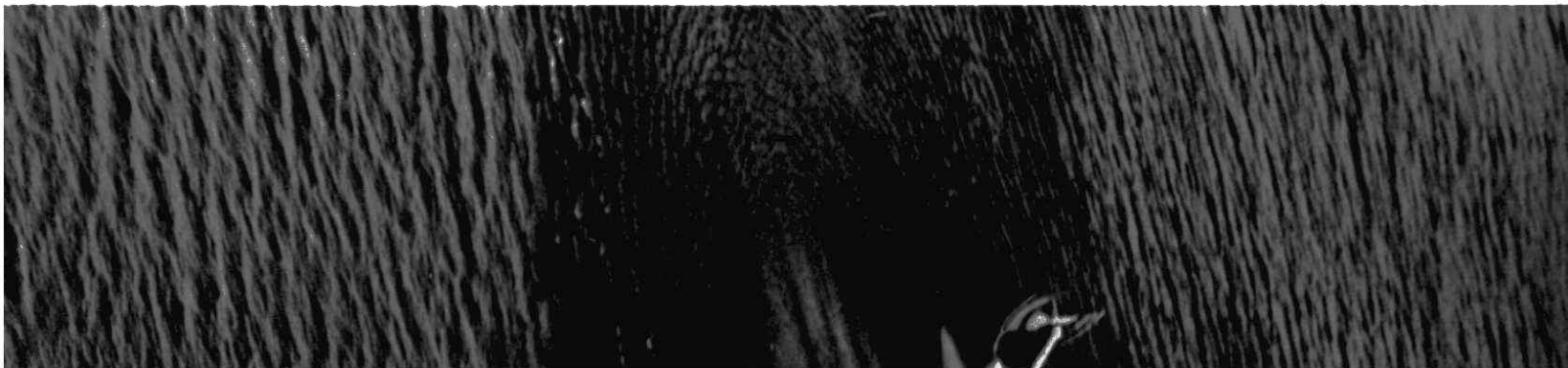
The diversity of the research programs undertaken during 1968 reflects the importance which is being placed upon this area of the Commission's activities. Research is being carried forward into the use of chemicals in the removal of nutrients from domestic sewage. Increased emphasis is also being placed upon the analysis of biological processes used in wastewater treatment—and particularly the development of techniques to assess both the applicability and performance of activated sludge systems in the treatment of such wastewaters.

While the level of sampling undertaken by the Commission's laboratory remained about the same as previous years, an improvement was effected in the methods of sampling employed and in the automation of some analyses. The laboratory was also expanded during the year to include the operation of a regional laboratory in London and plans were being developed, as the year ended, for a further regional laboratory at the Lakehead. A mobile laboratory was designed and put into operation during the year, as well, enabling on-site analyses of perishable samples.

In its continuing responsibility for the quantitative assessment and management of the Province's water resources, the Commission continued its water resources surveys, its test-drilling and well-construction projects, its collection of basic hydrometric data and its scientific hydrologic studies. In addition to

maintaining close co-operation with federal and other provincial agencies in the Northern Ontario Water Resources Study, the Commission continued to participate in such international water resources projects as the International Hydrological Decade program and the International Field Year on the Great Lakes.

A more detailed account of the Commission's activities has been provided in the following pages of this Report. Your review of this Report is invited.



Public Relations and Information

M. F. Cheetham, Director

Early in the 1968 fiscal year, the Commission's information program was completely re-organized following the appointment of a Director of Public Relations. The communications activities were re-assessed and specific areas of endeavour, covering exhibits, photography, editorial and special events were developed. Each member of the staff was assigned an area of responsibility with each individual required to develop programs based on the new terms of reference for the group.

Public Relations and Information is charged with the responsibility of developing an information and educational program, both internal and external, which correlates the policy, services and activities of the Commission. This program encompasses the development and production of print, audio-visual and educational aids, as well as the utilization of any other communications vehicle which is deemed advantageous to the overall objectives of the communications program. Underlying all these activities is the need to present a unified picture, accenting the identification of the Commission and co-ordinating all communications with the common purpose.

The 1968 exhibits season was the most active in recent years. Commission exhibits were on display at the Canadian Boat Show in Toronto; the annual conference of the Ontario Federation of Anglers and Hunters, Toronto; the Ontario Naturalists Meeting, Richmond Hill; the Tobacco Growers Exhibition, Tillsonburg; the Deep River Community Fair; the Water Well Drillers Conference, Toronto; the Canadian Lakehead Exhibition; the Peterborough Industrial Exhibition; the Central Canada Exhibition, Ottawa; the Canadian National Exhibition, Toronto; the Western Fair, London; the Lindsay Central Exhibition and the Royal Winter Fair, Toronto.

In addition, a permanent exhibit was installed

Promotional aids produced in 1968 for use in conjunction with the exhibits program were most successful. In particular was an "I'm for Clean Water" lapel sticker and the school bookcovers. Eighty-two thousand of the lapel stickers were distributed at the Canadian National Exhibition in Toronto, as well as 115,000 bookcovers. In total, 150,000 of the lapel stickers were distributed during the summer and fall exhibits season, these being particularly appealing to the younger fairgoers. Public requests made to Commission personnel attending the displays during the 1968 season resulted in the further distribution of 34,000 pieces of literature.

Supportive to the exhibits program, the Commission's student education program was also expanded during the year. An increasing number of presentations were made to student bodies, both at the elementary and secondary school levels, with the result that requests for this form of water management education is increasing weekly. Specific in the government exhibition area in the Rainbow Bridge Plaza in Niagara Falls. Two mobile displays were also developed which can be adapted to any conference or exhibition, the design being such that panels can be interchanged to meet a specific need or to communicate a special message. Four literature racks were produced, three of which were made available to the Commission's regional offices in London, Kingston and Fort William. This new publications service was developed in conjunction with a small film library so that the general public need not contact the Toronto office for materials, as they are now readily available through the regional offices. Bulk quantity requests continue to be handled through the PR&I office.

educational aids are being developed accenting the water management philosophy, and a new theme



"Watercare" was incorporated in materials being produced toward the latter part of the year. This theme is an integral part of bookcovers, lecture charts, exhibits, label stickers and any other educational item where its application seems appropriate.

The Photographic Section of PR&I accepted new challenges in film production during the year. The Commission's first internally-produced film "The Invisible River" was completed and its acceptance externally has been most creditable. A second film "Water Management in Ontario" was produced for incorporation in the exhibits program. This brief, fast-paced documentary recounts the activities of the Commission and its responsibility for water management.

A third film "The Choice Is Yours" was completed for the Commission during 1968 by an outside agency. Taking an aesthetic look at water and its relationship to mankind, within the perspective of the Commission, the film is primarily designed for screening to service clubs, church groups and other lay audiences.

A film library was also established with the result that the 45 prints maintained by the Commission are now fully utilized through a planned distribution program. The Commission's film library presently has available six motion pictures: The Invisible River; Water Management in Ontario; The River Must Live; Clean Water-It's your Decision; A Matter of Attitudes, and The Choice Is Yours. All of these are in continuous circulation and are serviced and maintained by PR&I. Some of the Commission's films are so popular that bookings are necessary two to three months in advance.

A third documentary film "Teamwork" is now being produced by PR&I. The film, which will be approximately 23 minutes in length, assesses the

role of the Commission in relation to the general public, stressing the need for co-operation and personal involvement if the water management objectives of the Province are to be achieved. It is expected that the film will be completed early in the next fiscal year.

In addition to its cinematographic activities, the Photographic Section also met the black-and-white and colour photographic needs of the Commission. A total of 2,500 pictures were supplied by this section during the year and an estimated 2½ miles of film recorded the overall activities of the Commission. The still photographs were utilized in exhibits, advertisements, publications, reports and various slide presentations required by division personnel. Photographs were also made available to numerous publishers, newspapers and magazines to illustrate water pollution articles and reports on the activities of the Commission.

A one-minute television commercial was produced during the year and made available to 26 English TV stations in the Province as well as to the CBC national network. It has been calculated that use of the news clip by the TV stations resulted in approximately \$75,000 "free time" public service promotion of the activities of the Commission.

In addition to the establishment of the film library during the year, other new services or procedures introduced or re-organized by PR&I included a comprehensive biographical-pictorial file on senior management of the Commission, the establishment of an inventory and stock control system relating to all publications and informational aids, the development of a series of lecture slides recounting the activities and areas of responsibilities of the Commission, and the calculation of the number of actual public contacts handled by PR&I during the year. With reference to the latter, statistics

indicate that PR&I received and took action on approximately 4,700 telephone calls, 3,400 personal calls, and 8,400 letters during 1968.

A complete re-organization took place in the Editorial Section of PR&I. This included the establishment of a regional news release distribution service, a review of the Commission's mailing list and its four-fold expansion with a higher degree of flexibility, and the compilation of an extended mailing list for the distribution of special Commission informational material. The new mailing list concept allows for distribution of news releases on a three-level basis—provincial, regional and local—rather than saturation distribution across the Province. Gearing the news stories to local interest assures better acceptability by the affected news media.

During the year, 72 news releases were produced. These covered all aspects and activities of the Commission and were distributed on a local, regional or provincial basis, depending on the subject matter. PR&I also designed and introduced a new tabloid newspaper entitled "Watertalk". The six-page tabloid is produced bi-monthly and distributed to all those interested in water management both within and without the Province. Not only does the publication allow for in-depth development of feature articles on the Commission, but it is also a vehicle of exchange for external philosophies and reports on the subject of water. Initially, "Watertalk" was produced in a quantity of 3,000 copies; however, its popularity and demand have been such as to necessitate the printing of nearly 7,000 copies of the most recent issue. With the introduction of "Watertalk", the employee-oriented "OWRC News" was terminated.

In addition to the 72 news releases mentioned above, the Editorial Section of PR&I also prepared a total of 87 individual articles for use in "Watertalk".

Many of these articles, with their accompanying illustrative photographs, were reproduced verbatim in daily and weekly newspapers around the Province. This in-depth treatment of specific aspects of the Commission's endeavours would not have been possible if the story had originally been released in news format. Five additional "one time" articles were also prepared in answer to specific requests by specific media.

PR&I collaborated with various business publications during the year in the preparation of feature articles on the subject of water management. Two of these were Modern Power and Engineering, which produced a special supplement on industrial pollution control, and Time Magazine, which featured an article entitled "Water Pollution: The Abuses of Abundance". Special editorial assignments included the preparation of material for speeches, reports and "ghost written" articles for various vertical business publications.

Four special event projects were undertaken by PR&I during the year, including the official dedication ceremonies of the Lake Huron Water Supply System at Grand Bend, the opening of the Big Bob River Water Supply System at Bobcaygeon and the Timiskaming Water Pollution Control Plant at Haileybury, and the signing ceremonies at Brampton relating to the OWRC-South Peel Municipal Agreement on a combined water/sewage system. In each instance, Public Relations and Information staff planned and executed all arrangements relating to each of these events as well as preparing supporting news media and guest informational material. PR&I also planned and co-ordinated four inspection trips made by the Commissioners to the eastern, northern, and north-western parts of the Province.

Throughout the year a planned identification conversion program was developed with respect to

the printing of all Commission literature. Primary concern was to adopt the Commission's new logo to all printed material and also to introduce more eye-appealing designs. Several new publications were commenced, such as, "Watercare", "Water Pollution—It's Cause and Cure", and two new versions of "The Story of Water". The new versions, entitled "My Water Book" and "The Water Story", are designed for grades three to seven and eight to thirteen, respectively. Each are individually written for their respective audiences and will introduce to these scholastic levels a completely new concept in water education material.

At the present time, the Commission has available through PR&I a total of 25 different pamphlets and brochures on water management and its related activities. Six additional publications are currently being produced. During 1968, a total of 169,000 copies of various OWRC publications and educational aids was distributed in addition to the previously mentioned label stickers, bookcovers and other materials resulting from direct requests through the Exhibits Section's program.

Ten thousand boat litter bags were also distributed by the Commission.

Combined total in literature and promotional aid distribution by PR&I by year's end was approximately half-a-million single units.

Three additional PR&I areas of activity include advertising, liaison with outside organizations and research. In mid-year a new advertising agency was appointed by the Commission and through this agency a new concept in advertising promotion was introduced. A 1,200-line advertisement announcing the implementation of the Boating Regulation and employing an "Is It Fair" method of approach was published in eleven major Ontario daily newspapers as well as in four boating publications. Supplement-

ing the advertisement was a series of promotional items which include a detailed map, identifying the location of pump-out stations throughout the Province, a digest of the Boating Regulation, the development of inspection decals for use in implementing the Regulation, and the reprinting of several hundred copies of the advertisement in reduced format for distribution at the Boat Show. A distinctive pump-out station metal sign was also designed and reproduced in quantity for distribution to marinas which have already installed pump-out facilities.

The agency is working closely with PR&I on the further development of this aspect of the overall communications program. Other advertisements are being proposed in the "Is It Fair" series and these will be supplemented by appropriate promotional aids as required.

In 1968 an awareness study was undertaken on behalf of the Commission by the Opinion Research Corporation. The results of the survey revealed that while over 80% of those interviewed placed water pollution second only to the cost of living as a matter of concern, only 10% could identify the OWRC as the Ontario government agency responsible for water pollution abatement. However, when the Commission was specifically identified, 78% admitted recognition, but of these more than half had an uninformed opinion of the Commission's activities. The results of the survey are being used as a benchmark for the development of the PR&I educational and information program over the ensuing months. A follow-up survey will be undertaken in twelve months to determine the effectiveness of this program.

During the year, PR&I staff were consulted by various agencies outside the Commission with respect to the co-ordination and implementation of

educational programs having common objectives. Two of these agencies were the Ontario Municipal Water Association and the Canadian Institute on Pollution Control. Public relations counsel and supportive literature were made available to these and other agencies in order to assist them in the development of their respective programs. Close liaison was also maintained with the Ontario Weekly Newspapers' Association with respect to the annual editorial contest on water resources. The North Essex News was the award winner in 1968 and a formal presentation was made to the editorial writer at the annual meeting of OWNA.

Progress and activity were the indices of the Commission's communications, education and informational program during 1968. Objectives were accomplished as a result of the re-organization of PR&I, but much still needs to be done if the percentage results of the Opinion Research Corporation's awareness study are to be significantly raised. This will only be possible through an accelerated, planned and continuous communications program.

Legal Branch

H. Landis, Senior Solicitor

The Legal Branch provided an advisory service to the Commission, its management and divisions.

During the year several prosecutions were carried out. Four corporations were convicted under s. 27(1) on nine charges of impairment of water. One of these convictions was the result of a successful appeal which led to an important clarification of the law applicable to future prosecutions under this section. Four individuals were convicted for breaches of the regulation respecting water wells and, in addition, a corporation was convicted under s. 31(1) for failure to obtain the approval of the Commission for the establishment of a sewage disposal system.

The Legal Branch also prepared mandatory reports under s. 38 to three municipalities and orders under s. 50 to two corporations regarding sewage treatment and disposal.

Two civil actions involving damage claims against the Commission were satisfactorily settled.

Papers entitled "Legal Control in Canada of Pollution in the Great Lakes Drainage Basin" and "Legal Problems in the Supply and Treatment of Water" were presented at the Great Lakes Water Resources Conference and at the annual convention of the Canadian Section, American Water Works Association, respectively, and, in addition, a lecture on the legal aspects of the supply and treatment of water was given as part of the Senior Water Works Operators' Course.

Personnel Branch

A. R. W. Uren, Director

Following activities initiated in 1967, negotiations with The Civil Service Association representing the Head Office bargaining unit and the plant bargaining unit continued in 1968. Agreement on management exclusions from the plant bargaining unit was reached on January 3, 1968, and negotiations for the management exclusions from the Head Office bargaining unit were concluded on March 7, 1968. Signing of these memoranda opened a way for general negotiations.

Agreement between the Commission and The Civil Service Association was reached on May 16, 1968, to cover employees in the Head Office bargaining unit and a Memorandum of Agreement was signed on July 4, 1968.

Negotiations with the plant bargaining unit commenced on April 6, 1968. The services of Joint Council were requested in July. Unresolved issues were referred to a mediator and terms of a settlement were worked out between the parties, providing the basis for a Memorandum of Agreement.

The Branch prepared and submitted a brief on behalf of the Commission on September 18, 1968, to His Honour Judge Walter Little, who was conducting a review of collective bargaining in the Ontario Government Service.

Recruitment, as usual, was an important part of the activity of the Branch. Interviews with 513 graduating students were conducted at 23 Canadian universities and 4 provincial institutes of technology in late 1967 and early 1968 to fill authorized professional positions. Secondary interviews with 48 candidates were subsequently held. Twenty-five accepted positions with the Commission.

New Provincial water works and sewage treatment plants came into operation at Cornwall,

Moosonee and Bobcaygeon. Competitions were advertised and interviews conducted at these locations and twelve positions were filled by qualified candidates.

Competitions for operators' positions were also conducted at 12 existing plants to fill vacancies created by resignations or transfers.

The bursary program of graduate training administered by the Branch provided grants and educational leave to 15 members of staff. The professionals selected entered graduate degree courses in sanitary engineering, environmental engineering, and science, to update their knowledge and skills in order to keep pace with the technical demands of their work.

Under the Commission's staff development program, 56 members of staff attended approved courses offered under university extension and evening courses at technological institutes and at technical and secondary schools. Upon successful completion of the course, reimbursement of 50 per cent of the tuition cost is made by the Commission.

Students of co-operative engineering and scientific courses have continued to be employed during their work terms. Seventeen students served for one term of four months, and six were employed for two work terms.

Applications for summer employment greatly exceeded the number of positions available. On July 1, 1968, 199 students were in the employ of the Commission. The majority were university undergraduates enrolled in engineering and science courses.

Students from institutes of arts and technology as well as from technical schools and secondary

schools offering arts and science courses were represented in the Commission's summer staff.

On December 31, 1968, the staff complement of the Commission was:

HEAD OFFICE ORGANIZATION

Permanent and temporary	723
Seasonal casual	40

PROVINCIAL WORKS

Permanent and temporary	33
Casual	5

PLANT OPERATIONS

Permanent and temporary	233
Regular part-time	18
Casual	25

Division of Administrative Services

L. M. Tobias, Director

In the second year of its formation the Division showed reasonable and positive progress in its attempt to provide service to the rest of the Commission.

Negotiations continued throughout most of the year with the Department of Public Works and its Associate Architect, Fisher Tedman and Glaister, concerning two capital construction programs for the Commission. One dealt with the proposed extension to the Laboratories building in Etobicoke and, at the year end, all but a few minor details of information had been provided by the Commission for the Associate Architect to complete his plans. It is anticipated that the approval of Treasury Board for construction will be sought in the Spring of 1969. The second project dealt with the construction of a Head Office Tower at the site of the OWRC Laboratory. Treasury Board subsequently allocated the building located at 135 St. Clair Ave. West and additional space at 40 St. Clair Ave. West to accommodate the OWRC Head Office function and, therefore, deferred consideration of a Head Office Administration Tower in Etobicoke until some time in the future.

The Director participated in the planning and organizing of the Great Lakes Water Resources Conference which was held in Toronto in the month of June and which was sponsored jointly by the American Society of Civil Engineers and the Engineering Institute of Canada. The Commission's annual Industrial Waste Conference was held in June and was a success both in terms of the attendance and in the quality of speakers and papers.

Negotiations were satisfactorily concluded for the renewal of the lease on the London Laboratory building at Stronach Crescent and for the opening of the London Regional Office on Dundas Street. As the year drew to a close, negotiations for the rental of

and renovations to a property in Fort William for the Lakehead Regional Office and Laboratory were nearing completion.

CENTRAL RECORDS

The changeover in the system of filing has been completed in the following areas: Sewage and Water Approvals, Subdivisions, Administrative Matters, International Joint Commission, Consultants Reports. The project files have not yet been completed although they are progressing favourably.

The following material was sent to the Government Records Retention Centre at Cooksville in accordance with the retention schedule:

- Municipal Files—up to December 1965
- Sewage Approvals—1964 and 1965
- Water Approvals—1964 and 1965
- Design Approval Files—up to December 1965
- Engineer Report Files—1960 to 1965
- Subject Matter—up to 1965
- Sewage Approvals—1966
- Water Approvals—1966
- Design Reports—up to 1968

Regional Office files were made up for London and Kingston. Files for the Lakehead have yet to be completed.

SYSTEMS AND EDP BRANCH

During 1968 a number of studies were conducted to determine the best approach the Commission should take to adequately satisfy its data processing needs. It is likely that the Commission will work toward the eventual installation of a computer terminal facility that will be connected on-line to the Department of Highways Computer.

Considerable work was done on the allocation of space, floor layouts, and the design of offices for the Commission's move from 801 Bay Street and 880 Bay Street to new enlarged quarters at 135 St. Clair

Avenue West and 40 St. Clair Avenue West. The first group moved into the new quarters late in December with the remainder of OWRC personnel being scheduled to move in by early February 1969.

Considerable time was devoted to studying clerical procedures in the Division of Laboratories with a view to streamlining much of this work, thereby providing a faster, more complete reporting service to both the Division of Laboratories and the operating divisions requiring laboratory analyses information. This work will continue through 1969.

In view of budget restrictions, it was necessary to re-examine the proposed schedule of projects to be developed. Projects deemed to have less than top priority were deferred, with effort being concentrated upon those areas of major importance to the Commission at this time. These areas include Laboratory Analyses Handling, Water Quality Surveys Projects and Hydrologic Data Studies.

PROCUREMENT BRANCH

The Procurement Branch comprises Purchasing, Stores, and Inventory Control and Invoice Verification. A description of the activities of these sections follows.

PURCHASING

During the 1968 calendar year Purchasing processed and mailed:

5564	Ordinary Vote Purchase	
	Orders for a total value of	\$ 2,555,797.56
4329	Operations Vote Purchase	
	Orders for a total value of	694,945.66
537	Capital Vote Purchase	
	Orders for a total value of	17,033,140.41
10430		\$20,283,883.63

PURCHASE ORDERS RELEASED

	1962	1963	1964	1965	1966	1967	1968
Ordinary	1300	2150	2474	3803	4368	5426	5564
Operations	2282	3010	3578	4187	4084	5094	4329
Capital	805	905	1167	565	487	598	537

In 1968 a total of 11,091 requisitions were issued for all three budgets as compared with 10,134 for 1967. This represents about a 10% increase in volume, despite the current practice of making annual stock purchases of stationery requirements and large quantity purchases of chemicals and other items, resulting in a reduction in the number of orders issued for these items. The actual dollar volume showed a marked increase, however—from about \$1,800,000 in 1967 to about \$2,400,000 in 1968—an increase of approximately 35%.

The Purchasing Section provided many services throughout the year. One of these services, for example, was the arranging of emergency-type service calls for office equipment (typewriters, adding machines, dictating equipment). Arrangements for a total of 517 such emergency service calls were made during the year—in addition to the scheduled annual service contracts issued for preventive maintenance purposes.

STORES

Receiving Section

There was a decline in the yearly total of water samples received at the main laboratory due to the disruptions which took place during the laboratory renovation program and the routing of samples to the London laboratory and to the mobile laboratory at Ottawa. The total number of incoming samples, shipments and packages for the year was 126,656.

Payments for express shipping and receiving increased to over \$10,000 as compared with \$6,700

last year. This increase was occasioned by the higher rail tariffs, more samples being expressed from far northern points and some essential use of expensive air express.

Shipping Section

Shipping activity was somewhat reduced during the year with outgoing shipments, packages and bottle numbering 114,387 as compared with 122,181 the previous year.

Glassware Processing

New equipment resulted in a more streamlined operation. This included a second Heinicke washing machine which eliminated considerable work stoppage because of breakdown, and a demineralizer which eliminated pumping out drums.

Research is being carried out with a view to reducing the current yearly consumption of detergent (2,600 lbs) by utilizing automatic dispensers.

Storage

The chemical stores area was inventoried and all stock levels were reviewed. Several branches of the Commission now have locked storage compartments in the field equipment warehouse.

Disposal of Obsolete Equipment

Equipment written off during the year included one boat trade-in, a 1953 Ford dump truck, a 1960 Chevrolet stationwagon and some other smaller items. Some equipment, pending disposal action, was renovated and pressed into service at temporary field locations. Some of the equipment which has become surplus as a result of the laboratory renovations will be used at the Lakehead Laboratory.

Capital Equipment Inventory

Items of capital equipment increased to a total of 3,200 during the year. While complete inventories were not possible during the year, spot checks were maintained on four sections of equipment—technical, mechanical, office equipment and furnishings. The clerical record of movement and location of equipment was kept current.

Planning—New Building Space

Many man hours were spent by Laboratory stores staff in meetings with the Department of Public Works, the architects, consultants and suppliers in order to provide data and requirements on equipment needs, material handling procedures, space requirements and layouts.

Stores Budget

The value of new equipment and supplies issued by Stores reached \$1,000,000 for the first time. Of this amount, \$117,000 was for payments on maintenance annual contract orders placed on behalf of the various divisions. Funds presently allocated to the stores budget are small, compared to stock turnover but most of the expenditures are pre-costed against the branches and divisions being serviced.

Stores Catalogues

Identical receiving procedures were set up for both the Laboratory stockroom and the 801 Bay Street stockroom. Stock numbering systems were compiled for the glassware, chemicals and laboratory smallwares sections. The chemical and stationery catalogues were revised.

Main Stockroom at Laboratory

One clerk was engaged for the entire month of April to fill orders required by the Ottawa Field Laboratory.

The plumbing and mechanical renovations being carried out were responsible, to some degree, for the dislocation of normal work routines.

A combined annual stationery order was prepared for the first time in May, in conjunction with the Bay Street stockroom. This arrangement has resulted in reduced costs, better stock availability, a reduction in requisitions, purchase orders and other paperwork. As a result of reorganization, items common to both stores areas can readily be exchanged internally, thus reducing the need to double stock or over stock in either locations.

Steps have been taken to develop an annual order system for all stock expendable items to obtain efficient and economical control. Annual turnover and re-order points were established for chemicals, laboratory smallwares and glasswares.

Numerical stock systems were devised to cover three stock sections—about 800 items of glassware, laboratory smallwares and chemicals—to facilitate speedier identification, issue and accuracy of posting. Sixteen inventories were taken during the year ensuring all stock items were accounted for at least once.

Bay Street Stockroom

Activities in this area for the year are compared with preceding years :

	1965	1966	1967	1968
Parcels—Out	1043	995	3156	3024
Mail, Total In & Out	118925	150835	198741	199153
Incoming Shipments	1337	1682	2033	2368
Items Requisitioned	4414	10332	13095	13013

Two new Regional Offices at London and the Lakehead established during the year were serviced with stationery and printed forms, in addition to the one already functioning at Kingston.

Full and accurate physical inventories of the stationery stockroom were taken and obsolete materials were cleared out. The bulk of the work involved in the preparation of the annual stationery order for both stores was undertaken by the Bay Street staff.

INVENTORY CONTROL & INVOICE VERIFICATION

Inventory Checks

Inventory checks at projects increased to 41, compared with 33 last year and involved 6,013 miles of travel. In addition to these, checks were made in 4 head office divisions. Handover/takeovers at projects, due to change of operators at projects, were required at six locations.

Invoices Processed

Invoices processed fall into three broad categories:

Utilities

3044	Hydro invoices valued at	\$742,325.00
231	Gas " " "	25,174.00
476	Water " " "	60,087.00
1274	Telephone " " "	26,406.00
Total	5025	\$853,992.00

Operating Vote

3448	Invoices covered by contracts and orders valued at	\$697,056.00
1182	Invoices against hardware accounts (under 15.00)	172,477.00
Total	4630	\$869,533.00

Ordinary Vote

8284 invoices having a
total value of \$1,734,734.00

During the past year complete coding of accounts was being done in this section and responsibility was assumed for cost verification on all accounts and gasoline tax refunds.

Division of Construction

A. Shattuck, Director
J. C. F. MacDonald, Assistant Director

During 1968 the Commission entered into 37 contracts valued at \$6,887,494.92, of which \$1,944,053.71 was for water works and \$4,943,441.21 was for sewage works.

During the year 51 contracts were completed. These had a total value of \$14,614,799.00 and consisted of 15 water works totalling \$2,538,515.00 and 36 sewage works totalling \$12,076,284.00.

ANSON, HINDON & MINDEN (6-0174-67)

Description of Project:

New well, pump and watermain.

Consulting Engineers:

R. V. Anderson Associates Ltd., Toronto.

Completed:

July 5, 1968.

Final Project Cost:

\$14,404.00.

ARTHUR (2-0230-67)

Description of Project:

Extensions to the existing sanitary sewerage system.

Consulting Engineers:

Philips & Roberts Ltd., Burlington.

Completed:

June 17, 1968.

Final Project Cost:

\$42,000.00.

BEETON (1-0006-66 & 2-0220-67)

Description of Project:

Sewerage system including sanitary sewers, services, factory-built pumping station, force-main and sewage lagoons.

Consulting Engineers:

Triton Engineering Services Ltd., Orangeville.

Expected Completion Date:

February 1969.

Estimated Project Cost:

\$380,000.00.

The contractor started work in July 1968 and by the end of the year had most of the installation completed. The factory-built pumping station and the diesel generator will be checked out in January 1969 and paving, where required, will be carried out in the spring of 1969.

BIG BOB RIVER WATER SUPPLY SYSTEM (5-0006-66)

Description of Project:

Water treatment plant and intake in the Village of Bobcaygeon.

Consulting Engineers:

Canadian Mitchell Associates Ltd., Bramalea.

Completed:

October 25, 1968.

Final Project Cost:

\$225,000.00.

CALEDON EAST (6-0167-67)

Description of Project:

Watermain extension.

Consulting Engineers:

R. V. Anderson Assoc. Ltd., Toronto.

Completed:

February 20, 1968.

Final Project Cost:

\$12,224.00.

TOWNSHIP OF CLARENCE (Bourget) (6-0176-67)

Description of Project:

Water distribution system and one booster pump.



Consulting Engineers :

J. L. Richards & Assoc. Ltd., Ottawa.

Expected Completion Date :

May 15, 1969.

Estimated Project Cost :

\$103,700.00.

Work started officially on October 14, 1968. The installation of watermains, hydrants and the booster pump was completed, as specified, by December 24, 1968. The completion of the installation of services was delayed until May 1969 at the request of the municipality to prevent damage to the existing wood stave system and interruption of the water supply.

COOKSTOWN (6-0182-68)

Description of Project :

1300 lineal feet of 6" diameter pipe extension to existing water distribution system.

Consulting Engineer :

W. D. Beckett, P.Eng., Barrie.

Expected Completion Date :

February 1969.

Estimated Project Cost :

\$12,000.00.

Tenders were opened on November 5, 1968, and work started in December 1968.

CORNWALL (2-0214-66)

Description of Project :

Contract 9—

Northern trunk sanitary sewer, Part I.

Final contract cost— \$346,509.00.

Contract 10—

Pitt St. combined relief sewer.

Final contract cost— \$417,000.00.

Contract 11—

Third St. West combined relief sewer.

Final contract cost— \$67,385.00.

Contract 12—

Twelfth St. sanitary sewer.

Final contract cost— \$37,902.00.

Contract 13—

Brookdale Ave. combined relief sewer.

Final contract cost— \$494,298.00.

Contract 14—

Northern trunk sanitary sewer, Part II.

Final contract cost— \$276,346.00.

Contract 16—

Baldwin Ave. storm relief sewer.

Final contract cost— \$230,864.00.

Consulting Engineers :

Gore & Storrie Ltd., Toronto.

Completed :

Contracts 9 & 14—

February 26, 1968.

Contract 10—

August 8, 1967.

Contracts 11 & 12—

June 17, 1968.

Contract 13—

November 15, 1968.

Contract 16—

October 4, 1968.

Estimated Project Cost :

\$2,170,000.00.

Contract 15, the western sanitary sewer, has been deleted from this project and will be constructed under a future project.

CORNWALL (2-0235-67)

Description of Project :

Contract 17A—

Water St. combined relief sewer.

Final contract cost—\$66,606.00.
Contract 17B—
Walton St. storm relief sewer.
Final contract cost—\$157,886.00.
Contract 17C—
Second St. storm relief sewer.
Final contract cost—\$275,471.00.
Consulting Engineers :
Gore & Storrie Ltd., Toronto.
Completed :
Contract 17A—
November 19, 1968.
Contract 17B—
October 3, 1968.
Contract 17C—
November 5, 1968.
Estimated Project Cost :
\$565,500.00.

TOWNSHIP OF CUMBERLAND (2-0190-67)

Description of Project :
A primary sewage treatment plant of 800,000
I.G.D. capacity.
Consulting Engineers :
J. L. Richards & Associates Ltd., Ottawa.
Expected Completion Date :
June 1, 1969.
Estimated Project Cost :
\$447,000.00.
Work commenced on November 5, 1968. By the
end of the year about 10% of the plant had been
completed.

DUFFIN'S CREEK POLLUTION CONTROL SYSTEM (1-0015-66)

Description of Project :
Contract 1—
Trunk sewer, sewage treatment plant and outfall

sewer to Duffin's Creek, in the Village of Pickering.
Est. contract cost—\$596,000.00.
Contract 2—
Sewage pumping station, forcemain and sewage
collector system in the Village of Pickering.
Est. contract cost—\$660,000.00.
Consulting Engineers :
Gore & Storrie Ltd., Toronto.
Expected Completion Date :
Contract 1—
April 1969.
Contract 2—
February 1969.
Estimated Project Cost :
\$1,372,000.00.

Tenders were received and opened on January 9,
1968. The lowest tender on Contract 1 was sub-
mitted by W. A. Stephenson Construction Co. Ltd.
and on Contract 2 by Valentine Enterprises Con-
tracting Ltd. The contracts were awarded April 5,
1968, and work was commenced immediately. By the
end of the year the work was approximately 80%
completed.

DURHAM (2-0023-67)

Description of Project :
Extensions to the existing sanitary sewerage
system.
Consulting Engineers :
M. M. Dillon Ltd., London.
Completed :
September 9, 1968.
Final Project Cost :
\$52,400.00.

ELORA (2-0234-67)

Description of Project:

Extensions to the sanitary sewage system.

Consulting Engineers:

R. V. Anderson Associates Ltd., Toronto.

Completed:

November 16, 1968.

Estimated Project Cost:

\$78,000.00.

ENGLISH RIVER POLLUTION CONTROL SYSTEM No. 1 (1-0061-67)

ENGLISH RIVER WATER SUPPLY SYSTEM (5-0031-67)

Description of Project:

Construction of municipal facilities in the Townsite of Ear Falls. Contract 1 (cost plus).

Consulting Engineers:

Proctor & Redfern, Toronto.

During 1968, a permanent water pumping station and intake were constructed to serve the townsite developed in 1967. In addition, another 20 mobile home sites were added to the existing trailer park.

The above work was completed in September as a continuation of the original cost-plus contract and at a cost of \$305,000.00.

The estimated total cost of the above projects, to date, is \$1,570,000.00.

FRANKFORD (2-0223-67 & 6-0168-67)

Description of Project:

Extensions to existing sewers and watermains.

Consulting Engineers:

DeLeuw, Cather & Co. of Canada Ltd., Don Mills.

Expected Completion Date:

April 20, 1969.

Estimated Project Cost:

\$148,152.00.

Work started on November 8, 1968, and is scheduled to be completed in May 1969. About 60% of the project was completed by the end of the year.

TOWNSHIP OF GLOUCESTER (Orleans) (6-0171-67)

Description of Project:

Extensions to existing watermains.

Consulting Engineers:

J. L. Richards & Assoc. Ltd., Ottawa.

Completed:

November 1, 1968.

Final Project Cost:

\$204,837.00.

GRAND BEND (6-0165-66)

Description of Project:

Approximately 41,000 ft. of asbestos cement watermain complete with valves, hydrants and service connections.

Consulting Engineers:

P. T. Mitches & Associates Ltd., London.

Expected Completion Date:

May 1969.

Estimated Project Cost:

\$402,000.00.

Work started early in July 1968 and by the end of the year approximately 90% of the watermains and service connections had been completed.

Towards the middle of December 1968, the distribution system north of the river was practically completed and water was fed to the system for the purpose of testing.

HASTINGS (6-0183-68)

Description of Project:

8" diameter watermain relocation.

Consulting Engineers:

Totten, Sims, Hubicki & Assoc. Ltd., Whitby.

Completed:
November 28, 1968.

Final Project Cost:
\$18,100.00.

HAVELOCK (6-0164-66)

Description of Project:
A well pumphouse and connection to the existing watermain.

Consulting Engineers:
Totten, Sims, Hubicki & Assoc. Ltd., Whitby.

Completed:
October 3, 1968.

Final Project Cost:
\$28,395.00.

KINCARDINE (2-0222-67)

Description of Project:
Extensions to the existing sanitary sewerage system.

Consulting Engineers:
B. M. Ross & Assoc. Ltd., Goderich.

Completed:
January 12, 1968.

Final Project Cost:
\$75,800.00.

KITCHENER (6-0178-68)

Description of Project:
6 m.g.d. reservoir extension and booster pumping station at the Mannheim Reservoir.

Consulting Engineers:
Proctor & Redfern, Toronto.

Expected Completion Date:
January 9, 1969.

Estimated Project Cost:
\$434,100.00.

Work was commenced on June 14, 1968, and was 98% completed by the end of the year. Delays occurred because of repairs to the existing reservoir.

LAKE ERIE WATER SUPPLY SYSTEM
(5-0002-65)

Description of Project:

Water supply system from Lake Erie to Reservoir in St. Thomas.

Consulting Engineers:
James F. MacLaren Ltd., Toronto.

Contract 9:
Booster pumping station.

Completed:
January 1968.

The final construction costs and completion dates for the various contracts are as follows:

	Completed	
Contract 1	June 1967	\$1,379,650
" 2	November 1967	1,090,878
" 3	December 1967	814,012
" 4	August 1967	745,898
" 5A	November 1967	1,765,155
" 5B	July 1967	403,828
" 6	—	Deferred
" 7	—	Deleted
" 8	May 1967	47,445
" 9	January 1968	157,778
Elevated tank	November 1967	118,574
Equipment	November 1967	430,000
Total		6,953,218
Engineering		667,772
		\$7,620,990

LAKE HURON WATER SUPPLY SYSTEM
(5-0001-64)

Description of Project:

Water supply system from Lake Huron at Grand Bend to Arva Reservoir.

Consulting Engineers:
James F. MacLaren Ltd., Toronto.

Contract 8:
Landscaping at Grand Bend plant.

Completed:

May 1968.

The final construction costs, excluding land, legal, survey, compensation for drainage and interest, are as follows:

	Completed	
Contract 1	December 1966	\$2,091,946
" 2	May 1967	1,861,527
" 3	June 1967	5,408,244
" 4	November 1966	4,364,535
" 5	January 1967	1,747,349
" 6	January 1967	1,095,838
" 7	July 1967	65,468
" 8	May 1968	52,008
" 9	November 1966	104,098
Engineering		1,216,127
Total		\$18,007,140

LAKE HURON WATER SUPPLY SYSTEM
(5-0018-66)

Secondary Supply Facilities—Village of Grand Bend.
Description of Project:

Approximately 12,500 feet of 14" diameter steel watermain from the Grand Bend treatment plant to the south limit of the Village of Grand Bend.

Consulting Engineers:

James F. MacLaren Ltd., London.

Expected Completion Date:

February 1969.

Estimated Project Cost:

\$205,000.00.

Work started early in July 1968 and by the end of the year all the pipe had been installed with the exception of the portion suspended from the bridge across the river.

LAKE SIMCOE POLLUTION CONTROL SYSTEM No. 1 (1-0008-66)

Description of Project:

Sewers, pumping station, forcemain and waste stabilization ponds to serve the Village of Beaverton.

Consulting Engineers:

W. O. Chisholm & Associates Ltd., Scarborough.

Expected Completion Date:

June 17, 1969.

Estimated Project Cost:

\$910,000.00.

Tenders were re-called and were opened on July 25, 1968. The lowest tender was submitted by Alcan-Colony & Affiliates to whom the contract was awarded August 22, 1968, and work was commenced immediately.

LAKE TIMISKAMING POLLUTION CONTROL CENTRE No. 1 (1-0069-67)

Description of Project:

Sewage pumping station, forcemain, prefabricated sewage treatment plant and outfall sewer to lake in the Town of Haileybury.

Consulting Engineers:

Hisey & Barrington, Willowdale.

Completed:

October 2, 1968.

Estimated Project Cost:

\$453,515.00.

LITTLE CURRENT (2-0228-67)

Description of Project:

Extensions to the existing sanitary sewerage system.

Consulting Engineers:

Kilborn Engineering Ltd., Toronto.

Completed:

April 29, 1968.

Estimated Project Cost:

\$53,000.00.

MARKDALE (2-0199-66)

Description of Project :

Sanitary sewers, service connections and lagoon.

Consulting Engineers :

R. V. Anderson Associates Ltd., Toronto.

Substantially Completed :

August 29, 1968.

Estimated Project Cost :

\$506,000.00.

Surface treatment of certain streets had to be delayed until the spring of 1969.

VILLAGE OF MARKHAM (2-0224-67)

Description of Project :

Extension to the existing sewage treatment plant.

Consulting Engineers :

R. V. Anderson Associates Ltd., Toronto.

Expected Completion Date :

February 1969.

Estimated Project Cost :

\$319,000.00.

Work was commenced in July 1968 and by the end of the year was approximately 95% completed.

MATTAWA (2-0233-67)

Description of Project :

Extensions to the existing sewerage system including a factory-built sewage pumping station.

Consulting Engineers :

Sutcliffe Co., New Liskeard.

Completed :

December 18, 1968.

Estimated Project Cost :

\$68,000.00.

MITCHELL (2-0211-66)

Description of Project :

Additional sewage Lagoon and ancillary works.

Consulting Engineer :

R. M. Dawson, Stratford.

Completed :

May 31, 1968.

Final Project Cost :

\$87,314.00.

The work outstanding from 1967 was completed and in operation by May 31, 1968, as scheduled.

MOOSONEE (5-0004-66 & 1-0002-66)

Description of Project :

Contract 1—

Sanitary sewers, storm sewers, watermains and road restoration on First Street.

Final contract cost—\$164,262.32.

Contract 2—

Supply and stockpiling granular material for construction of sewers, watermains, storm sewers and roadways.

Final contract cost—\$166,745.21.

Contract 3—

Sanitary sewers, watermains, storm sewers and roadways.

Estimated contract cost—\$643,500.00.

Contract 4—

Water works including dam, intake, low lift station and water treatment plant ;
Sewage works including prefabricated sewage treatment plant and two factory-built sewage lift stations.

Estimated contract cost—\$763,000.00.

Contract 5—

Extension of sanitary sewers, watermains and roadways.

Estimated contract cost—\$227,000.00.

Contract 6—
Construction of a roadway and twin structural
plate culverts.

Estimated contract cost—\$46,000.00.

Consulting Engineers :
Sutcliffe Co., New Liskeard.

Completed :

Contract 1—
July 15, 1967.

Contract 2—
March 1967.

Contract 3—
September 30, 1968.

Contract 4—
July 24, 1968.

Expected Completion Dates :

Contract 5—
August 1969.

Contract 6—
August 1969.

Estimated Project Cost :
\$2,100,000.00.

Work on Contract No. 5 started in mid-November
and by the end of December the sewers and water-
mains had been laid. The contractor requested per-
mission to suspend construction because of severe
winter conditions. Permission was given and it is
expected that work will resume in June 1969.

Commencement of work on Contract No. 6 was
postponed until the late spring of 1969.

TOWNSHIP OF MOUNTJOY (2-0195-65)

Description of Project :

Sanitary sewers, service connections, forcemain
and sewage pumping station.

Consulting Engineers :
Gore & Storrie Ltd., Toronto.

Completed :

August 1967.

Estimated Project Cost :
\$170,000.00.

The system continued in operation. The sewers
were cleaned in the spring using high pressure jet
cleaning equipment and were inspected photo-
graphically.

Discussions were held with the bond company
and it is expected that rectification of faulty sewers
will be carried out in 1969.

TOWNSHIP OF MOUNTJOY (6-0173-67)

Description of Project :

A connecting watermain across the river from
Timmins to Mountjoy.

Consulting Engineers :
Gore & Storrie Ltd., Toronto.

Completed :
April 30, 1968.

Estimated Project Cost :
\$43,000.00.

NEEBING (6-0172-67)

Description of Project :

Approximately 30,000 feet of 6, 12, 18 and 24
inch diameter watermains.

Consulting Engineers :
W. L. Wardrop & Associates Ltd., Fort William.

Estimated Project Cost :
\$804,504.00.

Tenders were received on November 5, 1968. It is
expected that a contract will be awarded and con-
struction begun early in 1969.

TOWNSHIP OF NEPEAN (2-0206-66)

Description of Project :

A secondary settling tank.

Consulting Engineers :
Gore & Storrie Ltd., Toronto.

Completed :
June 15, 1968.
Final Project Cost :
\$70,082.00.

**TOWNSHIPS OF NEPEAN, MARCH AND
GOULBOURN (2-0201-66)**

Description of Project :
A sanitary trunk sewer serving the above
townships.
Consulting Engineers :
Butts, Ross, Magwood and Hall Ltd., Ottawa.
Completed :
October 23, 1968.
Final Project Cost :
\$355,664.00.

NEW HAMBURG (2-0216-66)

Description of Project :
Extensions to existing sanitary sewerage system
with additional pumping station and lagoon.
Consulting Engineers :
McCargar and Hachborn Ltd., Kitchener.
Completed :
July 5, 1968.
Final Project Cost :
\$325,754.00.

Delays occurred through a number of reasons
and a total of three months extension of time was
granted. The extended system was completed and in
operation by July 5, 1968.

ORANGEVILLE (2-0208-66)

Description of Project :
Sewage treatment plant extension, Stage II.
Consulting Engineers :
Proctor & Redfern, Toronto.

Completed :
October 8, 1968.
Final Project Cost :
\$536,000.00.
Replacement of the aeration grids is under
discussion.

PORT COLBORNE (2-0219-67)

Description of Project :
Borden Area sewerage system.
Consulting Engineers :
Canadian British Engineering Consultants,
Toronto and Port Colborne.
Completed :
June 10, 1968.
Final Project Cost :
\$597,622.00.

PORT PERRY (6-0162-66)

Description of Project :
New well pump, pumphouse and watermain.
Consulting Engineers :
Totten, Sims & Associates Ltd., Whitby.
Completed :
February 19, 1968.
Final Project Cost :
\$80,835.00.

PORT STANLEY (6-0163-66)

Description of Project :
Approximately 5,100 lineal feet of watermain
(10" and 12" diameter).
Consulting Engineers :
James F. MacLaren Ltd., London.
Completed :
May 30, 1968.
Final Project Cost :
\$84,488.00.

**SKOOKUM BAY WATER SUPPLY SYSTEM
(5-0014-66)**

**HOWEY BAY POLLUTION CONTROL SYSTEM
(1-0040-66)**

Description of Project :

A complete sewage works system and a complete water works system for the Township of Red Lake.

Consulting Engineers :

W. L. Wardrop & Associates Ltd., Winnipeg.

Expected Completion Date :

July 1969.

Estimated Project Cost :

\$1,555,000.00.

This project is almost one year behind schedule, primarily as a result of vastly increased rock quantities at the site and the undulating nature of the rock. The contractor has been granted an extension of time for completion from November 30, 1968, to July 31, 1969.

**ST. LAWRENCE RIVER POLLUTION CONTROL
SYSTEM NO. 1 (1-0001-66)**

Description of Project :

Sewage works in the City of Cornwall.

Contract 5—

Riverfront interceptor sewer.

Final contract cost—\$2,724,400.00.

Contract 6—

Water pollution control plant.

Estimated contract cost—\$1,390,000.00.

Contract 7—

Sewage pumping station.

Estimated contract cost—\$682,000.00.

Contract 8—

Outfall to St. Lawrence River.

Final contract cost—\$219,840.00.

Consulting Engineers :

Gore & Storrie Ltd., Toronto.

Completed :

Contract 5—

December 16, 1968.

Contract 8—

December 15, 1967.

Expected Completion Date :

Contracts 6 and 7—

February 1969.

Estimated Project Cost :

\$6,309,000.00.

The system was placed in service on December 24, 1968, but further work is still required on Contracts 6 and 7 which are expected to be completed some time in February 1969.

SAULT STE. MARIE (2-0200-66)

Description of Project :

Contract 1—

First part of the Tarentorus Stage II trunk sewer comprising approximately 3,800 lineal feet of 18" diameter forcemain, valve chambers, wet well and pumping station.

Final contract cost—\$158,319.00.

Contract 2—

Second part of the Tarentorus Stage II trunk sewer comprising approximately 7,300 lineal feet and appurtenances.

Estimated contract cost—\$610,000.00.

Consulting Engineers :

Proctor & Redfern, Sault Ste. Marie.

Completed :

Contract 1—March 13, 1968.

Contract 2—September 30, 1968

Estimated Project Cost :

\$850,000.00.

SAULT STE. MARIE (2-0210-66)

Description of Project :

Modifications to Clark Creek sewage pumping station.

Consulting Engineers :

Proctor & Redfern, Sault Ste. Marie.

Completed :

December 1968.

Estimated Project Cost :

\$130,000.00.

Delays in delivery of equipment and strikes by plumbers, carpenters, etc., were responsible for late completion of the project.

STAYNER (6-0179-68)

Description of Project :

A deep well developed by the Division of Water Resources and the construction of a well pumphouse.

Consulting Engineers :

Gore & Storrie Ltd., Toronto.

Expected Completion Date :

February 1969.

Estimated Project Cost :

\$55,000.00.

The construction of the pumphouse was started in September 1968 and was 80% complete by the end of the year.

STRATFORD (2-0212-66)

Description of Project :

Chlorination facilities at the sewage treatment plant.

Consulting Engineers :

Canadian British Engineering Consultants, Toronto.

Completed :

September 11, 1968.

Estimated Project Cost :

\$152,783.00.

SUTTON (2-0229-67)

Description of Project :

Extension to the sanitary sewer system.

Consulting Engineers :

Kilborn Engineering Ltd., Toronto.

Completed :

November 13, 1968.

Final Project Cost :

\$147,620.00.

THOROLD (6-0169-67)

Description of Project :

Raw water gravity main and screen house.

Consulting Engineers :

Gore & Storrie Ltd., Toronto.

Completed :

August 2, 1968.

Final Project Cost :

\$363,708.00.

TRENTON (2-0225-67)

Description of Project :

Extensions to existing sewers, installation of one pumping station and forcemain.

Consulting Engineers :

Gore & Storrie Ltd., Toronto.

Expected Completion Date :

April 1, 1969.

Estimated Project Cost :

\$336,602.00.

The completion of the project was scheduled for December 15, 1968, but was delayed due to diffi-

culties in obtaining delivery of equipment. The system was, therefore, only partially in operation by the end of the year.

WALLACEBURG (2-0181-65, 2-0226-67 & 1-0087-67)

Description of Project :

Contract 1—

Trunk sanitary sewer (Gillard St.).

Final contract cost—\$128,750.00.

Contract 2—

Trunk sanitary sewer (Gillard and Wallace Streets).

Final contract cost—\$532,514.00.

Contract 2A—

Interceptor sewer (Wallace St.).

Final contract cost—\$43,858.00.

Contract 3—

Sanitary sewers and forcemain.

Estimated contract cost—\$670,273.00.

Contract 4—

Napier-Dundas pumping station.

Estimated contract cost—\$62,200.00.

Contracts 5A, 5B and 5C—

Sanitary sewers and forcemain.

Estimated contract cost—\$1,348,000.00.

Contracts 6, 7, 8, 9, 10 and 12—

Sanitary sewers, river crossings and pumping stations.

Estimated contract cost—\$1,592,600.00.

Contract 11—

Sewage treatment plant.

Estimated contract cost—\$1,316,000.00.

Consulting Engineers :

Todgham and Case Ltd., Chatham.

Gore & Storrie Ltd., Toronto.

Completed :

Contract 1—

June 28, 1966.

Contract 2—

June 20, 1967.

Contract 2A—

April 22, 1968.

Estimated Project Cost :

\$6,594,443.00.

Schedule :

Contract 3—

Commencement anticipated early in 1969.

Contract 4—

Commencement anticipated mid-1969.

Contracts 5A, 5B and 5C—

Commencement anticipated mid-1969.

Contract 11—

Commencement anticipated early in 1969.

Contracts 6 to 10 and 12—

Plans and specifications are being prepared by the consulting engineers.

WATERLOO (2-0203-66)

Description of Project :

Extensions to the sewage treatment plant.

Consulting Engineers :

Proctor & Redfern, Toronto.

Completed :

December 13, 1968.

Estimated Project Cost :

\$1,297,000.00.

The work, in general, was completed and put into operation by December 13, 1968, although some minor items remained outstanding and will be completed early in 1969.

YORK-TORONTO REGION POLLUTION
CONTROL SYSTEM NO. 1 (1-0013-66 &
2-0177-64).

Description of Project:

Sanitary sewer system for the Village of Wood-
bridge.

Consulting Engineers:

Proctor & Redfern, Toronto.

Completed:

August 2, 1968.

Final Project Costs:

Project 1-0013-66—\$333,700.00.

Project 2-0177-64—\$743,810.00.

This project was completed almost two months
behind schedule even though the contractor had
been given a liberal extension of time for completion.
Liquidated damages and engineering costs were
deducted from monies paid to the contractor for this
period.



Division of Finance

E. F. Heath,
Director and Comptroller

In 1968, the Division of Finance executed financial control over the many facets of funds which came within the Commission's jurisdiction. This control was achieved by the active participation and co-ordination of the General Accounting, Budget, Insurance and Audit Branches.

The supporting information and data, set out below, indicate the activities for 1968.

General Accounting

The following statistics reflect the annual increase in the volume of accounting activities:

(A) RECEIPTS FROM BILLINGS TO MUNICIPALITIES

	Debt Retirement	Reserve for Contingencies	
1966	\$1,701,159	\$637,203	
1967	\$1,786,096	\$646,799	
1968	\$1,946,264	\$678,881	
	Interest	Operations	Total
	\$4,074,182	\$2,966,788	\$9,379,332
	\$4,295,839	\$3,499,553	\$10,228,287
	\$4,736,032	\$3,850,272	\$11,211,449

(B) REVENUE FROM PROVINCIAL PROGRAMS

1967	\$ 506,437
1968	\$1,498,843
1969	\$2,605,000 (Est.)

(C) EXPENDITURES IN THE OPERATION OF WATER AND SEWAGE TREATMENT PLANTS

1966	\$3,006,232
1967	\$3,617,833
1968	\$4,231,497

(D) GENERAL EXPENDITURES

1966/67	\$6,203,294
1967/68	\$7,773,560
1968/69	\$9,492,550 (Est.)

(E) GROSS CAPITAL DISBURSEMENTS

1966/67	\$25,029,984
1967/68	\$19,450,405
1968/69	\$15,236,915 (Est.)

(F) GROSS CAPITAL RECEIPTS

	Subsidies Winter Works	Payments from Municipalities C.M.H.C. and Others	Total
1966/67	\$654,909	\$3,683,019	\$4,337,928
1967/68	\$472,793	\$4,687,945	\$5,160,738
1968/69	\$348,274*	\$6,986,298*	\$7,334,572*

*Estimated

(G) LOANS FROM PROVINCE OF ONTARIO FOR PURPOSE OF CONSTRUCTING WATER AND SEWAGE PROJECTS AS AT DECEMBER 31, 1968.

Municipal Projects	\$ 88,163,397.59
Provincial Projects	39,035,753.03
Total	\$127,199,150.62

Budget

During the year, the Budget Branch assembled all pertinent data required in the preparation of the Commission's annual budgets, maintained financial control of the funds for its programs and activities, and provided assistance to many of the Directors in the preparation of their annual estimates.

In the 1968/69 fiscal year, the general expenditures for the Commission's programs totalled \$9,492,550. These expenditures were reported to various levels of management on a monthly basis in comparative form of budget/actual. On many occasions additional statistical and cost information was supplied upon request.

In order to maintain the essentials of a good cost system, the classification of expenditures was



OWRC's new Head Office building in Toronto.

further developed to reflect the changing budget structure of the Commission, resulting from the "program budgeting" approach applied in establishing its estimates. Each year's classified expenditures provide additional cost records and historical data on the expenditures of the various activities and are most useful to Management in assessing future estimates as well as providing essential information for current and long-term forecast trends.

Insurance

The continuing review of insurance coverages was maintained throughout the year. The addition of projects completed during the year brought the total insurance carried by the Commission to \$66,931,300.00. The number of claims processed during the year totalled 29, a reduction of 30% from 1967. On December 31, 1968, the Commission's Comprehensive General Liability Insurance was renewed for three years. During the year, the Branch also acted as Consultants for the Drilling and Production Section of the Energy Branch of the Department of Energy and Resources Management with regard to the oil and gas drilling and production activities on Lake Erie.

Audit

During 1968, this Branch performed a pre-audit of all operating expenditures, year-end precepts, quarterly billings and supporting schedules. In addition, capital and ordinary vote expenditures were reviewed on a sample basis. The current audit program was continually reviewed and up-dated to provide assurance that adequate emphasis was placed on the financial data developed within the Commission, to ensure that Commission assets were safeguarded

from losses of all types and to determine the adequacy and application of accounting controls and the extent of compliance throughout the Commission with respect to existing controls, policies and procedures.

During 1968, considerable emphasis was placed on the auditing of payrolls for both Plant Operators and Head Office Casual staff, and field audits at Commission projects. A detailed audit of the Ear Falls, Phase 1, project costs was completed, including an examination of the Contractor's records.

Assistance, with respect to financial problems, was provided as requested. This assistance included areas within the Commission as well as Municipalities faced with problems in their water and utility accounting.

ONTARIO WATER RESOURCES COMMISSION
(Constituted by special Act of the Ontario Legislature)

BALANCE SHEET
AS AT DECEMBER 31, 1968

Assets	
CAPITAL ACCOUNT	
Cash in bank	\$ 1,036,273.10
Recoverable advances	74,742.29
Accounts receivable	1,658,968.46
Capital assets	
Completed projects owned by Ontario Water Resources Commission	91,064,125.71
Capital advances for completed municipal projects	29,146,319.69
Construction in progress	13,926,418.82
Amounts due from reserve account	15,257.02
	\$136,922,105.09
RESERVE ACCOUNT	
Cash in bank	\$ 45,110.59
Accrued interest receivable	77,193.59
Investments	
(Market value \$3,741,587.51)	4,416,779.04
	\$ 4,539,083.22
DEBT RETIREMENT ACCOUNT	
Cash in bank	\$ 10,316.57
Accrued interest receivable	244,117.73
Investments	
(Market Value \$11,571,705.63)	13,597,514.29
Amounts due from capital account	15,389.80
	\$ 13,867,338.39
	\$155,328,526.70

Liabilities	
CAPITAL ACCOUNT	
Accounts payable and contract retentions	\$ 3,674,179.60
Advances from municipalities and others	
Operating and interest	\$1,349,778.67
Capital	4,583,606.40
	5,933,385.07
Due to Province of Ontario	
Treasury Department advance	100,000.00
Funded debt payable to Province of Ontario	127,199,150.62
Amounts due to debt retirement account	15,389.80
	\$136,922,105.09
RESERVE ACCOUNT	
Funds for renewals, replacements and contingencies under Section 43 of the Act	\$ 4,523,826.20
Amounts due to capital account	15,257.02
	\$ 4,539,083.22
DEBT RETIREMENT ACCOUNT	
Sinking fund for the recovery of the cost of capital assets at 3¼% under Section 44 of the Act	\$ 13,867,338.39
	\$ 13,867,338.39
	\$155,328,526.70

NOTE: As at December 31, 1968, commitments have been made under final agreements executed for the construction and acquisition of projects requiring additional gross expenditures of approximately \$99,000,000.00, of which \$31,000,000.00 is estimated to be expended during 1969.

Division of Industrial Wastes

D. P. Caplice, Director

H. A. Clarke, Assistant Director

The Division of Industrial Wastes is responsible for the administration of the OWRC industrial pollution control program and performs a regulatory function under Sections 27, 31 and 50 of the OWRC Act. The activities of the Division are coordinated by the Administration Branch and fall into three general areas: Field Services, Design Approvals and Special Projects.

The Field Services Branch regularly assesses all sources of industrial pollution and prepares reports setting out the volume, character and pollutional content of the discharges. These reports provide the basis for maintaining an inventory of industrial waste loadings to watercourses, determining the status of control and the action required to obtain compliance with the Commission's objectives. Another function of this Branch is to advise industries and municipalities regarding pollution control relating to the location of new plants and the expansion of existing plants. Problems associated with the discharge of industrial wastes to municipal sewage systems are investigated by field personnel. To ensure that adequate control is maintained on discharges to watercourses, the Branch has a regular surveillance program.

The Design Approvals and Special Projects Branch carries out the following functions: (1) the review of engineering plans from industry where the effluent from the proposed treatment works will be discharged to a watercourse or storm sewer, and the issuing of certificates of approval under the terms of Section 31 of the OWRC Act; (2) arranges public hearings concerning applications where the proposed works are to extend from one municipality to another; (3) provides specialized technical appraisal of difficult waste control problems on an individual company or industry-wide basis; (4) reviews design reports for provincially-financed municipal sewerage

schemes with respect to industrial waste loadings; and (5) provides advice and assistance to municipalities in the preparation of sewer-use by-laws to regulate industrial discharge to municipal sewers.

FIELD SERVICES BRANCH

The character of the Division's field work changed somewhat in 1968 reflecting the progress being achieved in pollution control by industry. Most existing plants have effected a degree of effluent control or have established programs to do so.

New industries are installing treatment facilities before commencing operations. Thus, the trend in the field program is away from intensive plant surveys, which define the pollution problem, and more towards the routine surveillance and evaluation of waste treatment works with a view to checking treated effluent conditions against OWRC objectives.

Effluent quality control programs are being set up at all plants having significant discharges to watercourses and the companies are being asked to provide summary reports at stipulated intervals.

Approximately twenty-two hundred field contacts were made by Field Services personnel in 1968. Two hundred and fifty-five intensive surveys were carried out which resulted in two hundred and fourteen formal reports. Field staff participated in two hundred and eighty-one meetings and consultations relating to industrial pollution control. A summary of activity in the major industrial classifications and the status of pollution control is given below.

Status of Control in the Major Industries

(a) Basic Iron and Steel

During 1968, the basic steel producers brought into operation expanded process capacity and announced



further expansions. Generally, waste control equipment for the new facilities was engineered along with the production facilities. In addition, the industry continued its efforts to deal with problems from existing operations with emphasis being placed on the control of oil. This is the major problem to be solved in the basic steel industry.

The Algoma Steel Corporation, Limited, has experienced a severe delay in the completion of its phenol recovery plant. Now due to be completed in 1969, it will also serve the recently expanded coking operations. Continuing pilot plant studies on treatment of coke plant wastes are encouraging and efficient removal of certain waste constituents is indicated. The Company's program for oil control has been intensified. Improved maintenance and the installation of additional separators and skimmers has occurred. A major item in controlling oil losses—a terminal settling and skimming basin on the main plant sewer—is being designed with construction to commence early in 1969.

Dominion Foundries and Steel, Limited, is overcoming troublesome operating problems in some of the major pollution abatement projects which it undertook during 1967. A terminal settling basin serving the basic operations (coking and iron and steel production) was completed. Improved oil collection and removal facilities were also instituted. The two major projects presently under active consideration are further improvements in oil control and spent pickle liquor disposal.

The Steel Company of Canada, Limited, brought into production a new blast furnace and additional coke ovens. Coke plant wastes were handled in the existing phenol recovery plant, and a new clarifier was installed to handle the gas cleaning wastes from the new blast furnace. Changes were begun in the

finishing works, at Hamilton and elsewhere, to convert existing pickling operations to hydrochloric acid, with the spent acid being trucked to the main plant for regeneration. To reduce oil losses, improved oil collection and removal facilities were installed, and a comprehensive survey of all plant wastes was carried out by an outside consultant.

In connection with proposed installations at other locations, discussions were held and/or applications for approval were received for the proposed Stelco development at Nanticoke, the Falconbridge Nickel Mines, Limited, iron ore plant near Falconbridge and the Great Lakes Forgings, Limited, plant, recovering iron from scrap turnings, in the Windsor area. Finally, the waste treatment and disposal operations of the Lake Ontario Steel Products plant at Whitby were improved and at the year end were operating satisfactorily.

(b) Chemical and Petroleum

Activities in the chemical and petroleum industries to control pollution at existing and new plants continued at a high rate. During the year, fourteen applications were received dealing with waste control or treatment systems for existing problems. These applications covered the spending of \$856,300 for capital works and engineering charges and included submissions from Du Pont of Canada, Limited, Chemical Developments of Canada, Limited, and Electric Reduction Company of Canada, Limited. The submission from the Electric Reduction Company of Canada, Limited, deals with a program for the total recirculation and re-use of wastewaters and, when the program has been implemented, it is anticipated that the plant will not have a direct liquid waste discharge to the Grand River.

In addition, applications were received covering

the installation of pollution control facilities at eight new plants at a total estimated cost of approximately \$1,076,800. Notable in this area were applications received from Dow Chemical of Canada, Limited, Allied Chemical Canada, Limited, and Shell Canada, Limited. The applications from Dow Chemical of Canada, Limited, and Shell Canada, Limited, deal with a new plant and a modification to an operating procedure, respectively. When both programs have been implemented and continuous trouble-free operation established, the amount of salt discharged to the St. Clair River should be reduced significantly.

In addition to the routine surveillance program that continued with this group of industries, two major studies were carried out. The first involved an intensive survey of the seven oil refineries in the Province to review the sources and characteristics of wastes and methods of treatment and disposal. The information collected is being compiled for inclusion in a status report which will summarize the current state of waste control in the industry and permit ready comparison of one refinery to another. The second study encompassed a similar survey at Polymer Corporation, Limited, which was deemed necessary because of the size and complexity of the industry.

(c) Food Processing

Significant progress continued to be made towards having complete pollution control measures instituted in the food processing industry during 1968. This classification includes dairies, meat packing plants, potato processing plants, distilleries and canneries.

Applications for Commission approval of waste treatment works were received from twenty-three companies, including Salada Foods, Limited, Campbell Soup Company, Limited, and Hiram Walker and Sons, Limited. Nineteen certificates of approval were

issued for facilities costing \$1,010,900 during the calendar year. Of noteworthy mention is the biological treatment plant built by Salada Foods, Limited, at its potato processing plant at Alliston, which appears to have finally solved a long standing pollution problem in that area.

Canneries continue to pose the most difficult waste control problems in the food processing industry. Because of the rather short operating season and the strong wastes that are generated and which require extensive treatment facilities, progress has been slow, mainly because of the large capital expenditures involved for proper treatment. However, of the few companies remaining without effluent control works, most are submitting schedules to the Commission for corrective measures.

Close surveillance of food processing plants continues to be necessary. It has been found that frequent checking of the plants that have installed waste control facilities is still required to ensure that the treatment works are maintained and operated properly. Extensive surveys were carried out at a number of food processing plants located in municipalities which are planning to install or enlarge sewage treatment works. As the wastes from these industries can be readily treated with the municipal wastes, the feasibility of joint treatment is being investigated at a number of locations. Thorough surveys were conducted at these plants to develop industrial wastes data for use in the design of these municipal facilities.

(d) Mining

An active surveillance program was carried out in 1968 at the mines of the Province, with special attention being given to the nickel mine being developed by The International Nickel Company of

Canada, Limited, (INCO) at Lake Shebandown, the Griffith Mine of The Steel Company of Canada, Limited, at Bruce Lake, and the INCO and Falconbridge mining complex in the Sudbury area.

Seventeen applications for the installation of waste treatment facilities were approved during the year. The capital and engineering cost of works proposed in these applications totalled \$1,400,300.

Efforts continued in the Cobalt area in an attempt to establish satisfactory waste disposal systems for the operating silver mines. It appears that the selection of a central disposal basin may be a significant factor in solving the pollution problem of this area.

The problem of stabilizing and rehabilitating tailings piles through vegetative growths was studied extensively during the year and the report of a Committee on Mines Tailings Disposal Practices should be available early in 1969. The success of The International Nickel Company of Canada, Limited, in Sudbury in growing hay on tailings arising from its nickel and copper operations has been well documented. Good progress was made in achieving vegetative cover on tailings areas from gold mining operations in the Timmins area.

(e) Pulp and Paper

As in previous years, in-plant control measures to minimize material losses to sewers comprised the major portion of the work done by the pulp and paper companies. Emphasis continued to centre on reducing the suspended solids content in effluents, with minor consideration being given to those waste materials which lower dissolved oxygen levels in receiving streams. Six applications for approval of waste treatment works valued at \$1,006,300 were processed.

Close contact was maintained with the industry during the year and surveys were done at all 32 mills

which discharge to natural watercourses. In many instances, industrial waste reports on treatment and disposal practices were complemented by biological and water quality reports prepared by other divisions within the OWRC. These reports have proven to be of much value in assessing the effects of pulp and paper mill wastes on the receiving streams. With the help of the Canadian Pulp and Paper Association (CPPA), the pulp and paper mills in the Province of Ontario agreed to submit effluent data to the OWRC on a quarterly basis. These data sheets, together with annual company reports, OWRC surveys and the CPPA annual report to the Commission on the overall industrial picture in Ontario, provide a comprehensive status of the pollution control program.

The Abitibi group of mills continued to be active in reducing bark and fibre losses in waste discharges. Studies on the centrifuged system have proven successful and this equipment is now operating satisfactorily on woodroom wastes at the Fort William mill. Lagoons at this site are also substantially reducing the bark fines content of woodroom wastes. Abitibi is conducting other studies on clarification of mill effluents and is investigating incineration of spent cooking liquors with the recovery of chemicals at one location.

In the St. Catharines area, The Ontario Paper Company, Limited, has under construction a clarifier to remove suspended material, and pilot plant studies are under way to determine how to reduce the wastes with a high oxygen demand. At the Lakehead, The Great Lakes Paper Company, Limited, is continuing to implement its comprehensive program of pollution control. Based on this and other work, it can be stated that progress was made during the year by the pulp and paper industry in its complex and costly water pollution control program.

(f) Secondary Industries

This category includes the relatively smaller miscellaneous industries such as metal plating and fabrication plants, textile plants, tanneries, rendering plants and other associated industries.

The metal plating and finishing plants generate liquid wastes that are inherently toxic, containing such undesirable components as cyanides, alkalies, acids, oils and dissolved metals. A straight discharge of these wastes to a sanitary sewer can upset the proper operation of the sewage treatment plant by killing the organisms which are essential to the activated sludge process. A similar discharge of these wastes to a natural watercourse may result in extensive fish kills. Of necessity, these wastes require extensive treatment to render them non-deleterious prior to disposal.

Treatment of wastes from this industry normally consists of neutralization, precipitation of metal ions, cyanide destruction and oil removal. In 1968, Anaconda American Brass, Limited, Decor Metal Products, Limited, Hahn Brass, Limited, and Amerock, Limited, constructed the necessary treatment works or completed initial phases as part of a staged program leading towards the installation of complete treatment works. The total cost of the above projects amounted to \$350,000.

The textile, tanning and associated industries produce liquid wastes that are essentially organic in nature, containing high concentrations of suspended solids and oxygen demanding materials. Wastes of this type have always been considered amenable to treatment in sewage treatment plants, provided that the waste loadings have been reduced sufficiently through pretreatment or in-plant control. The general trend continued to be one in which the process

wastes were rendered acceptable for discharge to a sanitary sewer for ultimate treatment at the sewage treatment plant. Canada Glue Company, Limited, in Brantford, on the other hand, eliminated one of the main waste producing operations of this type by stopping the production of animal glue, thereby removing one of the major sources of pollution to the Grand River.

The service industries, for the most part, discharge oil-bearing liquid wastes from the maintenance shops, fuelling depots, washing platforms, etc., and these require treatment to remove the oils. In 1968, the Division stressed to the railway industry, in particular, that proper waste control was necessary at all the critical depots to eliminate all sources of pollution originating from these operations. As a result, both the CPR in North Bay and the CNR in Etobicoke provided the necessary measures to have the final effluents meet the OWRC objectives. Plans were also drawn up by the industry for additional new facilities to be provided at other locations in 1969.

It should be noted that in 1968 a number of new sewage treatment plants were planned for many communities under the Provincial financing scheme. As the secondary industries produce relatively small volumes of liquid wastes, negotiations were started to have many of the plants discharge their wastes to the sanitary sewers as part of the overall treatment scheme designed for the municipality. Once these provincial sewage treatment plants are completed and placed in operation, a considerable number of existing pollution problems should be eliminated in smaller municipalities.

Industrial Pollution Control in Municipalities

The disposal of industrial wastes to municipal sewerage systems is a major factor in the overall control of



industrial pollution in the Province. Municipal sewage treatment systems are not always able, however, to accommodate the unregulated discharge of industrial wastes. The provision, therefore, of advice and assistance to municipalities in the regulation and treatment of industrial wastes is an important part of the Division's activities. During the year, sixteen municipal industrial pollution surveys were carried out varying in scope and complexity from small municipalities such as Mildmay and Forest to major urban centres such as Windsor, Chatham and Belleville.

Major proposals for the pretreatment of industrial wastes are reviewed by the Design Approvals Branch as a service to the particular municipality. Proposals for the extensive pretreatment of tannery wastes in Barrie and distillery wastes in Collingwood are examples of proposals which were reviewed during the year.

DESIGN APPROVAL AND SPECIAL PROJECTS BRANCH

(a) Design Approvals

Control of industrial waste disposal is regulated through the implementation of Section 31 of the OWRC Act, which requires industry to submit applications to the Commission for approval of plans for the collection, transmission, treatment and disposal of industrial wastes. Applications are reviewed and, if found satisfactory, certificates of approval are issued. OWRC approvals are announced in news releases whereby the industries, government and other agencies and the general public are kept advised of the continuing growth of industrial waste treatment in the Province.

Table I summarizes the processing of applications in 1968 and Table II is a breakdown, by industry, of the 85 certificates issued in 1968, involving estimated

total costs of \$5,299,700. An additional 17 submissions fell into the categories of works already under construction or systems for in-plant recovery and were given concurrences. The estimated cost of these projects was \$496,900.

The application of Campbell Soup Company, Limited, to install waste treatment facilities at a new poultry processing plant in the Township of Blanshard is an interesting example of the involvement and co-operation of government agencies, consultants and private groups in the development and appraisal of a treatment project. The groups involved in the project included four divisions of the OWRC, the company, two firms of consulting engineers, the Department of Energy and Resources Management, the Upper Thames River Conservation Authority and the Philadelphia Academy of Natural Sciences. The treatment facilities consist of in-plant screening and grease separation, an activated sludge treatment unit, sludge spray irrigation, and chlorination of the effluent before discharge to the Thames River. The estimated cost is \$330,000.

Seven applications covered installations which involved the transporting of wastes across municipal boundaries. In accordance with Section 32 of the OWRC Act, public hearings were held in connection with all seven applications.

Table 1
Summary of Projects for 1968

	Items	Estimated Capital Cost
Applications outstanding as of December 31, 1967	27	
Applications received in 1968	99	
Total	126	
Certificates of Approval issued	85	\$5,299,700
Applications reviewed—concurrence given	17	496,900
Total	102	\$5,796,600
Applications reviewed—approval not given	6	
Applications under review or in abeyance as of December 31, 1968	18	\$2,365,900
Total	24	
Project Meetings—at OWRC offices	91	
Project Meetings—on site	53	
Total	144	
Public Hearings (OWRC Act, Section 32)	7	

TABLE 2
1968 Certificates Issued—Industry Classification

	Number of Certificates	Capital Cost
Chemical and Petroleum	18	\$1,161,000
Food	19	1,010,900
Manufacturing	18	476,400
Mining	17	1,400,300
Pulp and Paper	6	1,006,300
Services	4	71,700
Steel	3	173,100
	85	\$5,299,700

(b) Special Projects

Provincial Sewage Works Program

The evaluation of the industrial waste aspects in the design reports for provincial sewage works programs is a continuing function of this group. In 1968, 68

reports were reviewed and 20 meetings were attended by staff in regard to this function.

Municipal Sewer-Use By-Laws

Many municipalities have become increasingly aware of the potential problems associated with the discharge of industrial wastes to the sewer system and have requested guidance towards enactment of the necessary control measures. During 1968, 46 municipalities were forwarded information on sewer-use by-laws, 10 proposed sewer-use by-laws were reviewed and 9 municipalities forwarded by-laws which are being enacted.

Also, during the year, a brochure entitled "Industrial Pollution Control in Municipalities" was completed and given wide circulation to persons involved in this field of activity. This brochure was well received and, to date, almost 5,000 copies have been distributed to interested persons.

Uranium Mining, Milling and Refining Industry

Liaison was maintained with the uranium mining, milling and refining industry with surveys being conducted at all the operating mines in the Province. Meetings were held with the officials of a mine under construction in the Agnew Lake area to discuss the implementation of satisfactory controls of tailings impoundment and effluent treatment.

Special Studies

A report was issued on investigations into the sources, characteristics, treatment and disposal of wastes from Uniroyal (1966), Limited, at Elmira. The report also included results of waste treatability studies and bioassays on various toxic streams from

the plant. A number of steps are being taken by the company to provide a waste which is more amenable to treatment at the Elmira water pollution control plant.

Committees

Committee work continued at a high pace in 1968. Staff participated on the Ad Hoc Safety Committee for the proposed uranium hexafluoride plant of Eldorado Nuclear, Limited, at Port Hope. This Committee, representing many government departments, is reviewing all aspects of control being instituted by the company to protect the environment.

A committee on mines tailings disposal practices set up a program of sampling and analysis of tailings from various types of milling processes with a view to recommending ways of establishing good vegetative cover for permanently stabilizing tailings areas.

Matters continued to be dealt with on the Reactor Safety Advisory Committee dealing with the control of radioactive pollution from the Douglas Point and the proposed Pickering power generating stations. A member of staff is helping the Canadian Institute for Pollution Control to develop a manual on industrial wastes and municipal practices.

Activities continued on two sub-committees to the Deputy Ministers Advisory Committee on Pollution Control, namely industrial wastes and radioactivity. Representation continued on the Water Quality Objectives Committee towards the completion of a document for Commission approval.

Thermal Generating Stations

The increase in demand for electrical power has resulted in plans for construction of a number of new generating plants by Ontario Hydro. These installations, both nuclear and coal-fired, are being located

on the lower Great Lakes system. The vast quantities of cooling water required by this industry and the resultant heat input to the receiving lakes have raised many questions about the potential effects on the aquatic environment. Ontario Hydro and the OWRC are working closely on water quality, biological and physical studies in the Nanticoke and Pickering areas. The Department of Lands and Forests is also involved at Nanticoke because of the proximity of a small mouth bass fishery at Douglas Point. It is expected that studies at these locations will aid in predicting some of the thermal effects of such installations.

Division of Laboratories

J. H. Neil, Director

The Division of Laboratories provides technical support for many programs of the Commission through chemical, bacterial and biological analyses and by conducting biological field survey programs for the assessment of water quality. In 1968, the workload of submitted samples leveled off to approximately the same as for the previous year (Fig. 1). The information provided in Figure 2 shows the distribution of those samples received from within the Commission and those from other government and municipal agencies. Table I summarizes the number of samples received and the number of tests done.

TABLE I

	No. of Samples		% Increase
	1967	1968	
Bacteriology	42,940	43,858	+ 2.0%
Biology	7,065	5,340	-24.0%
Chemistry I	57,720	57,478	- 0.4%
Chemistry II	.	.	.
Total	107,725	106,676	- 0.9%

	No. of Tests		% Increase
	1967	1968	
Bacteriology	114,117	121,040	+ 6.0%
Biology	6,653	14,189	+113.0%
Chemistry I	420,315	417,715	- 0.6%
Chemistry II	21,258	28,291	+ 33.0%
Total	562,403	581,235	+ 3.4%

*Chemistry II figures included with Chemistry I figures

In general, the sample load better matched the capability of the laboratory to perform the required analyses than it has in the past. While the level of samples and the work force remained relatively constant, improvements in methods and automation of some analyses reduced the overtime work requirements considerably from the previous year. These technical improvements enabled the adoption of better checking procedures and enabled field support to be provided in the mobile laboratories for on-site

analyses of perishable samples. The establishment of field support for intensive survey programs of the Commission, such as was provided by the large mobile laboratory for the Ottawa River survey, is a new service of the Division. Field support units will assume increasing importance as the emphasis of the Commission's activity shifts from determining sources and extent of pollution to measuring causes and effects and monitoring improvements brought about by abatement measures.

The development of regional laboratories was a major activity during the year. Early in 1968, arrangements were made for the majority of chemical and bacterial analyses originating in Southwestern Ontario to be handled by the London laboratory, which had previously worked on IJC Great Lakes samples exclusively. Direct liaison with the newly established London Regional Office developed well, with the laboratory providing sampling supplies, scheduling surveys and providing for direct reporting of analytical results. At the year end, all design and equipment-ordering for the establishment of a new laboratory in Fort William, part of the Lakehead Regional Office, was completed. The laboratory will go into full operation prior to the commencement of the 1969 summer sampling season.

The objective established for the complete conversion of result-reporting to an EDP system during 1968 was not achieved. The development of systems procedures through several divisions of the Commission and progress with critical decisions on the type and location of processing equipment put this program behind schedule.

The Biology Branch carried out a number of important intensive surveys of lakes and rivers associated with IJC and OWRC-oriented pollution investigations. It also played a lead role in establishing a program to monitor the pesticide level in fish in

Fig. 1

Annual Samples Received and the Number of Tests Performed. (1956-1968)

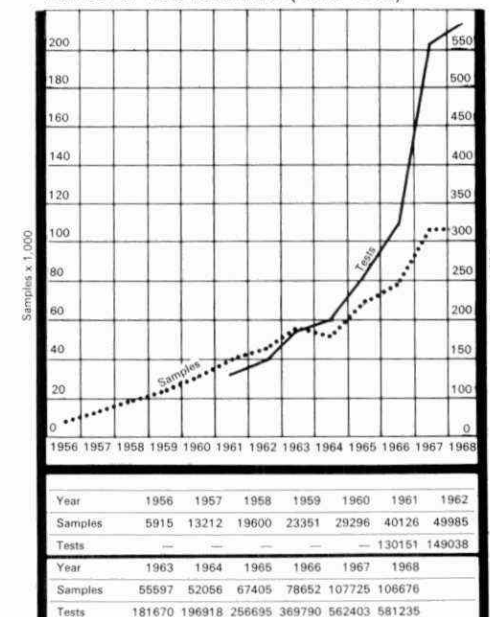


Fig. 2

Summary of Sample Sources.

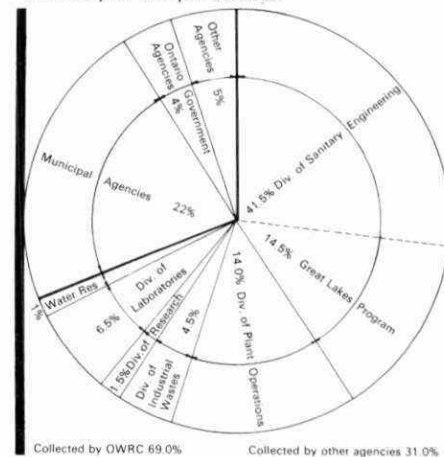
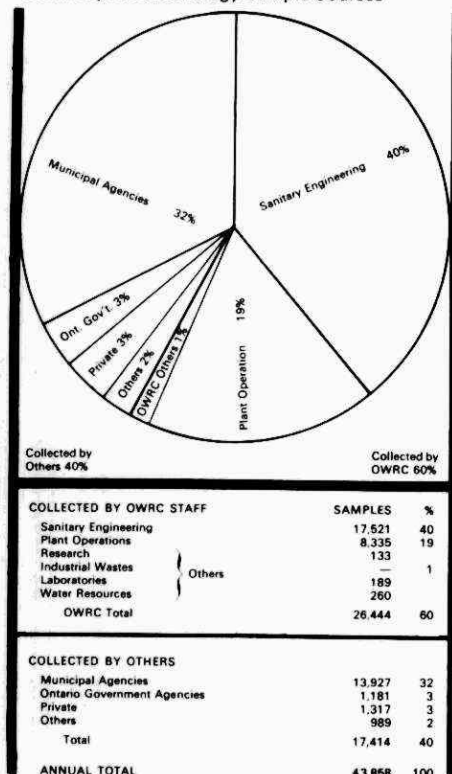


Fig. 3
Summary of Bacteriology Sample Sources



selected waters and in controlling direct applications of all pesticides to water for the purpose of nuisance control, through a permit system.

Plans for an expansion of the laboratory facilities were actively developed during the year. In August, sketch plans were completed by the architect employed by the Department of Public Works. These were submitted to the Treasury Board for approval which would then allow detailed planning to the stage of completion of working drawings. This approval was received and, at the end of the year, the laboratory design was nearing completion. The construction of a laboratory building requires close liaison between the user and the designer. For this reason, much time was spent by laboratory staff on this project, from the development of concepts to the planning of each room in complete detail.

The Laboratory participated in international analytical reference service programs where laboratory competence is tested by analyses of standard samples and where selected laboratories are requested to assist with the testing and development of new tests. Scientific staff of the Division also presented and published a number of important scientific papers.

BACTERIOLOGY BRANCH

The Bacteriological Branch provided 60% of its analytical services to the work of the Commission's divisions, with the remaining 40% to that of other provincial and municipal government bodies and public groups. A breakdown of samples received will be found in Figure 3. Drinking water samples continued to form the largest single workload, while surface waters formed the next large block of sample submissions. Statistics of sample submissions will be found in Table 2. A two percent increase in sample

submissions over 1967 was recorded, with 43,858 samples analyzed.

Determinations increased to 121,040, with a wider variety of tests being performed. Figures 4 and 5 provide numbers of samples received since 1956 and determinations performed since 1961.

The total water sample submissions from drinking water sources increased by 18% over 1967, with 24,764 analyzed. These were analyzed in the Toronto and London laboratories, with the Toronto laboratory handling approximately 21,000. The bacteriological analysis of regularly submitted drinking water samples from selected municipalities was modified from the routine Membrane Filter (MF) analysis to an integrated MF and Presence-Absence (P-A) test procedure. The Presence-Absence test was developed in the Commission's laboratory and has been generally adopted as the routine test for treated drinking water samples. A paper, detailing the method, was published in the Canadian Journal of Bacteriology. This test is less expensive and permits the detection of fecal pollution parameters. The major portion of the drinking water samples was analyzed by the P-A test alone, while the remainder received both MF and P-A tests. By the end of the year, 52 municipalities were involved in this program, for which summary reports have been prepared every four months.

At least 90% of the samples from distribution systems of most municipalities were negative for coliform bacteria. Some of the smaller municipalities had slightly more than 10% of their samples positive for coliforms. When municipalities submitted samples on a regular basis, a better index of their drinking water quality was obtained.

Bacteria, such as *Enterococci*, *Pseudomonas*, *Clostridia* and a variety of other heterotrophs and autotrophs, has provided details for better under-

standing of water quality problems.

Routine samples, collected by the Water Quality Surveys Branch from the Great Lakes, numbered 7,519 in 1968, some 37% less than the previous year. Most of these were analyzed in the Toronto laboratory, with the remainder examined in the London laboratory, a mobile bacteriological laboratory and a temporary field location.

Development work, using as many of these samples as practicable, was performed in order to improve the understanding of microbial characteristics of these waters. Methods were developed to enumerate the sulfite-reducing *Clostridia* from water and sediments, and an inverted membrane filter-in-molten-agar technique was devised for use with water samples. Approximately 3,000 isolates from water and sediments from Lake Ontario were identified to the generic level. *Aeromonas* types comprised a significant proportion of the organisms found on coliform plates. Plate count isolates from sediments were predominantly proteolytic bacteria of the genera *Alcaligenes*, *Acinetobacter* and *Bacillus*.

Plate count isolates from water were grouped according to coliform level and water sample temperature of the sample. The incidence of *Acinetobacter* isolates was associated with increasing coliform levels and of *Proteus* isolates with increasing water temperature. Members of the genus *Pseudomonas* occurred with similar frequency at all coliform levels but decreased significantly at water temperatures above 15°C.

An intensive sampling program was carried out in Western Lake Erie. Depth samples were collected on nine successive days and analyzed for four parameters. Significant variations among daily results occurred at most stations for all parameters. A report, detailing bacteriological findings, was prepared and

integrated with findings of the chemical and algal conditions.

A preliminary report on the effect of storage time and temperature on the density of coliform, "background" and plate count organisms in lake waters was prepared. Results indicated strong dependence on initial bacterial densities and on storage temperature; smaller containers showed greater density changes.

Coliform and plate count results for the 1967 Great Lakes Survey were summarized and cartograms were prepared.

A one-year study of Toronto Harbour was initiated in July to investigate the daily variation in bacteriological parameters employed in water quality evaluation and the relationship of these parameters to physical, chemical and biological measurements.

A report on the current status of bacteriological information on the Great Lakes was prepared as part of a publication of the Great Lakes Institute.

A mobile laboratory was designed, built and put into operation in connection with the 1968 Great Lakes work. It consisted of a 14' x 8' trailer, constructed and outfitted to perform bacterial analyses under field conditions. It was continuously used from April to October, supporting the work of the survey crews on Lake Erie and Lake Superior and the St. Marys River, and was involved in seven major survey areas. This laboratory was also used for an Ottawa River survey in November. Its mobility allowed for perishable samples to be properly analyzed to produce significant information, and it was found to be a great asset to field survey work. Bacteriological support was also provided for two Great Lakes surveys where field crews made temporary use of the Department of Health Laboratories in Sault Ste. Marie and the facilities of the Welland County Health Unit.

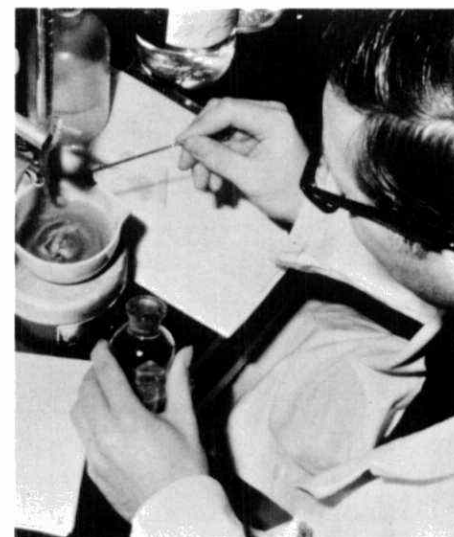


Fig. 4

Total Tests from 1956 to 1968

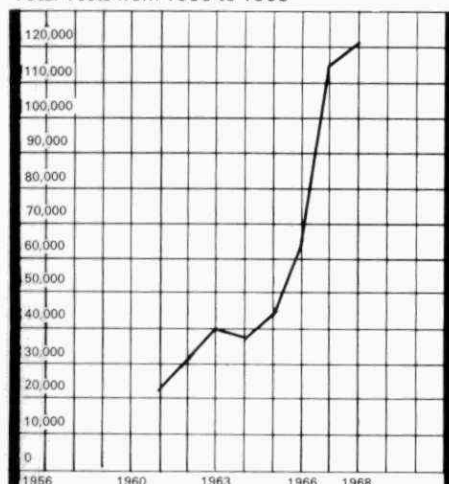
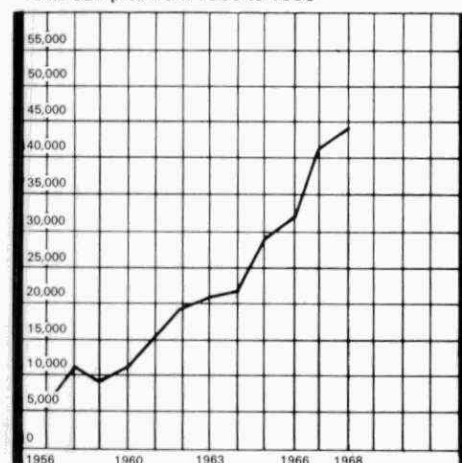


Fig. 5

Total Samples from 1956 to 1968



The bacteriological section of the London laboratory analyzed 6,858 samples in 1968, virtually the same number as in 1967 (6,864). A 49% increase was noted for regional samples, providing greater services to that area. Fewer samples received from the Great Lakes Survey allowed for this extension of service.

The large mobile laboratory, equipped and staffed to do chemical and bacteriological analyses, was located in Ottawa. Analyses of the Ottawa River and tributary samples were carried out as part of the interprovincial river survey. The four usual parameters were used to obtain information on bacterial quality.

An extensive review of literature pertaining to the ecology of river microorganisms was made, stressing the automatic organisms involved in sulphur and nitrogen transformation. Studies, carried out in conjunction with the surveys of the Ottawa River and Rainy River, showed that sulphur microorganisms inhabiting sediments and the water column may be of use in evaluation the long and short-term effects of paper mill wastes on rivers. New counting techniques were developed for enumerating the sulphate-reducing microorganisms.

A survey of Elliot Lake waters, affected by uranium mine wastes, was also made. The pH conditions in these waters were found to be depressed by appreciable populations of the sulphur bacterium *Thiobacillus thiooxidans*, which is capable of developing in these acid waters of tailings basins.

Tentative objectives were submitted to the Committee on Water Quality Objectives, following an extensive review of the literature on raw water standards. Specific water quality objectives were prepared for the Great Lakes, following a review on available data on these waters.

Members of staff participated in the Great Lakes Methodology Working Committee. Several discussions and tours were arranged for individuals and groups having mutual interest in microbiology of water.

The following graphical and tabular material summarizes the numbers, types of samples received by the Branch and the sources from which samples are submitted.

Table 2

Comparison of Sample and Test Statistic for 1967 and 1968.

	1967	1968	Percentage Increase
Drinking Water Samples	20,258	24,764	18
Surface Water Samples	19,442	16,070	-21
Sewage & Waste Samples	3,152	2,867	-10
Miscellaneous Samples	88	157	44
Total Samples	42,940	43,858	2
Total Determinations	114,177	121,040	6
Great Lakes Samples	10,281	7,519	-37
London Lab.			
Regional Samples	1,785	3,469	49
Samples Unsuitable for Analyses	263	156	

BIOLOGY BRANCH

Pollution evaluation surveys were carried out in all regions of the Province in 1968 to determine the impact of industrial and municipal discharges on receiving waters. Particular attention was paid to assessing effects on aquatic life.

In connection with the continued co-operative studies between the OWRC and the International Joint Commission, biological surveys were completed on the Niagara, St. Clair and Detroit Rivers to complement monitoring of chemical and bacteriological conditions carried out by the Water Quality Surveys Branch of the Division of Sanitary Engi-

neering. A major watershed survey was commenced on the Ottawa River to assess the effects of municipal discharges and the input of wastes from the several paper mills located on this important waterway. The Wabigoon River in northwestern Ontario was investigated to determine the need for improved controls on paper mill wastes. Fish were obtained during this survey in order that laboratory evaluations for potential fish tainting could be completed. In southern Ontario, effects from combined municipal and industrial wastes were investigated on the Nottawasaga River and cognizance was taken of possible relationships between water quality and the use of agricultural pesticides in the watershed area. A cooperative program was established with the Lamprey Control Unit of the Canada Department of Fisheries on several tributaries of the Nottawasaga to ensure that lampriciding was not having deleterious effects on game fish and other desirable stream life. The second half of a two-year project on the Credit River was completed in which biological effects associated with nutrient contributions were considered in the light of urban development and agricultural practices, as well as land use types.

Less intensive spot and surveillance surveys were undertaken to determine the effects of localized pollution and to indicate possible alterations in water quality in the lower Trent River, Port Hope harbour, Canagagigue Creek, Bruce and Pakwash Lakes, and Tetapaga Lake and adjacent Lake Temagami. A pre-operational survey was carried out on Agnew Lake and the adjacent Spanish River to collect background information prior to the commencement of uranium mining activities in the Agnew Lake area.

Reports were completed on biological surveys carried out in 1967 on Nipigon Bay, Lake St. John, Rat Portage Bay and the Winnipeg River, the lower Spanish River, the St. Marys River, and Rankin Lake.

Additional reports on the Moira River, Abitibi River and Sydenham River neared completion at the year's end.

Considerable effort was devoted to compiling the biological portion of the report to the International Joint Commission on the lower Great Lakes. The biological section contained information on bottom fauna, phytoplankton, chlorophyll levels, zooplankton, algae *Cladophora*, and DDE (a DDT metabolite) levels in fish. A sub-section on fish populations was provided by the Department of Lands and Forests.

All biological survey work was completed on schedule in connection with a three-year program in the Elliot Lake and Bancroft areas to assess the effects of radioactive and chemical pollution on aquatic populations. In the Serpent River watershed, in the vicinity of Elliot Lake, emphasis during the year was placed on fish population studies and the capture of fish for radiological analyses. Activity commenced on the compilation of survey data gathered over the three-year period in order to complete a report on this study in 1969.

The annual Algae Identification and Enumeration Course, held early in April, was attended by participants from thirteen municipalities and one university. To provide a useful teaching aid, sets of permanent algae slides were prepared for use by the trainees, each containing 50 genera of phytoplankton per set. Several new lectures were incorporated into the course material. Visits were paid to twelve water treatment plants throughout the year to assist with counting techniques and to deal with matters relating to the Provincial Phytoplankton Enumeration Program. Regular phytoplankton counts were submitted to the Branch over the year from water works personnel at Cornwall, Kingston, Smith Falls, Peterborough, Lindsay, Metropolitan Toronto, Sud-



bury, Hamilton, Dunnville, Cedar Springs, Union, Sarnia, Grand Bend and Goderich.

Further progress was made throughout the year in evaluating relationships between phytoplankton and taste and odour production. Samples were submitted weekly from five municipalities for phytoplankton counts and chemical analyses and three-day studies were carried out at each water treatment plant in the winter and late summer. On these occasions, phytoplankton counts, chemical analyses and threshold odour tests were completed on raw water samples, on samples representing various stages of treatment and on those taken from the distribution system.

A number of investigations were carried out to assess the degree of eutrophication of a number of lakes, including Lake Muskoka, Belwood Lake, Conestogo Lake, Little Lake Panache and Riley Lake. Reports were prepared outlining the nature and causes of aquatic enrichment in the latter two bodies of water.

A co-operative program with the Chemistry and Bacteriology branches was designed to evaluate methodology, desired frequency of sampling and reliability of sampling by performing daily analyses on samples collected from two locations—one in Toronto Harbour and the other from the raw water intake at the R. C. Harris Water Filtration Plant in Toronto.

A number of evaluations were carried out on surface waters which had potential as municipal supply sources. Waters assessed included Dog Lake, Long Lake, Lake Benard, Nith River, Keesquashing River, Nebskwaski River, the Bay of Quinte near Deseronto, Montreal River, Big Rideau Lake, Cyprus Lake and Lake Ontario at Kingston. A total of 180 evaluations of algae-caused problems and interpretations of laboratory analyses was forwarded to

OWRC staff, consulting firms and private individuals.

A number of new analytical and interpretative techniques were incorporated into the regular laboratory program. Speciation of diatom algae was enhanced by the preparation of acid-washed slides. Greater objectivity in evaluations of phytoplankton communities was obtained through use of the 'species diversity' concept; this approach was employed successfully in evaluating changes in phytoplankton communities affected by acid-mine wastes in the Elliot Lake area.

Lists of algal and bottom fauna species reported throughout the Great Lakes were prepared for inclusion in the appendix of a book entitled 'The Lake as an Environment' which is being prepared by the University of Toronto.

A province-wide monitoring program for establishing DDT levels in fish was established in co-operation with the Fish and Wildlife Branch of the Department of Lands and Forests and the Ontario Pesticide Laboratory at Guelph. Approximately 1,000 analyses for DDE were completed on fish samples at the Commission laboratory to establish the significance of the DDT residue problem in Ontario waters.

Investigations were completed on Golden Lake near Pembroke to determine the suitability of a new larvicide for control of swimmers' itch. The magnitude of the swimmers' itch problem in this lake was determined in order to establish the projected cost of control measures.

As part of a three-year study initiated in 1967, thirty plots supporting growths of cattails were partially re-sprayed with four herbicides to determine effective application rates, optimum treatment time and regrowth potential. Applications of amitrole, dalapon and paraquat after seed head formation were much more effective than spring treatments. Nine

additional plots were treated for the first time with a new herbicide in pellet form.

Endothal-fenoprop and 2,4-D ester applied to eight plots in one small lake, provided unsatisfactory control of yellow and white water lilies. Virtually total recovery of submerged aquatic plants was observed in eighteen plastic enclosures treated with three experimental herbicides.

Five of six ponds treated with diuron on a total volume basis showed that seasonal control of filamentous algae, stonewort, *Chara* sp. and pondweeds *Potamogeton* spp. could be obtained.

The use of diuron in a single drawdown treatment prevented the development of aquatic vegetation for the entire season.

Lake studies were undertaken to evaluate four new experimental herbicides against several species of aquatic vegetation in Rice Lake. Several large scale aquatic plant control projects undertaken by cottagers' associations were supervised by Branch personnel and an application of 2,4-D to more than 500 acres in Rondeau Bay for milfoil control was organized in co-operation with staff of the Department of Lands and Forests at Aylmer.

Recommendations for aquatic herbicides were made to the annual meeting of the Ontario Herbicide Committee for incorporation into the 1969 edition of the Guide to Chemical Weed Control—Publication 75 of the Department of Agriculture.

Fish bioassays were completed on 155 samples, involving a total of 8,260 tests including supporting chemical and physical measurements. The tests included 38 surface water samples, 24 industrial wastes, 18 pesticides and 75 miscellaneous chemicals. Taste evaluation tests were completed on samples of fish from the Wabigoon River system.

A total of 23 fish kills were reported for the year, a decline of five from 1967. A breakdown of causes

for these fish mortalities is as follows: industrial wastes 5, temperature increase 2, natural causes 9, unknown 5 and miscellaneous 2. Several kills involved fish numbering to approximately 1,000. Game fish were involved in 10 cases.

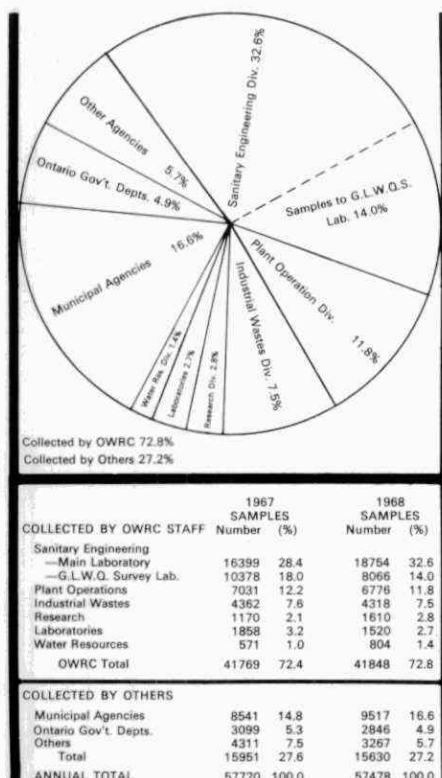
Table 3

SUMMARY:	Samples Received		Determinations Completed	
	1968	1967	1968	1967
Algae counts	2839	3559	2668	3018
Identifications	137	232	237	94
Threshold odours	162	39	143	39
A.G.P. samples	64	—	151	—
Bioassays	155	110	8260	964
Pesticides (fish)	484	420	942	498
Zooplankton	168	520	51	102
Bottom fauna	1277	2133	1041	1866
Plants	18	—	18	—
Taste tests (fish)	32	32	192	52
Miscellaneous	4	20	4	20
Algal Bioassays			20	
Acid Slides			462	
Total	5340	7065	14,189	6653

CHEMISTRY I BRANCH

The major development of the year took place in the application of the Technicon AutoAnalyzer to the performance of 'Nutrient' tests. Methods development work, begun in 1967, culminated, early this year, in the successful adaption of this automatic analytical instrument for the performance of all six routine tests for nutrient components in samples, including soluble and total phosphorus, ammonia, total Kjeldahl, nitrate and nitrite nitrogen. A unique method was devised for the digestion of samples, which allowed both total Kjeldahl nitrogen and total phosphorus to be analyzed simultaneously on the same digested sample. This provided a substantial economy in that now only one digestion is required

Fig. 6
Summary of Chemistry Sample Sources



per sample in place of the two separate digestions and one distillation required previously. In addition, an AutoAnalyzer assembly was developed which allowed the remaining four tests to be performed simultaneously on one filtered portion of the sample. Besides the savings in labour achieved by the elimination of the preparation of four separate portions of sample, equipment costs were reduced substantially through a reduction in the number of AutoAnalyzer components required. In the four-channel instrument developed for these tests, only one sampling unit, one pumping unit and two recorders were required, in place of four of each of these components which would have been required to set up individual single channel assemblies for the same purpose.

Early in the year, two additional advances in applying the AutoAnalyzer were developed which made possible a substantial increase in output. Procedures, which allowed for the operation of both AutoAnalyzer assemblies for an additional shift in the evening without technicians in attendance, doubled the potential instrument capacity. To process the extra recorder graphs thus produced, a device was contrived which allowed both current records and the previous night's graphs to be read and the final analytical result to be calculated while these graphs remained in place in the recorder. This made possible a much shorter throughput interval between sample preparation and the reporting of the final analytical result. With the additional capacity gained by these improvements it was possible to analyze not only the Main Laboratory samples, but perform all nutrient tests on Great Lakes Survey samples for the Toronto laboratory section as well. The output of tests thus obtained from the Main Laboratory Auto-Analyzers contributed a total of one-quarter of the entire Chemistry I Branch analytical output.

Further AutoAnalyzer equipment delivered in the spring allowed the London and mobile laboratories to adopt the techniques developed at the Main Laboratory. By May, all nutrient tests, wherever performed, were conducted using the new automatic analytical techniques.

Four further polarographic Dissolved Oxygen meters were constructed by staff and a manual detailing methods of construction, operation and maintenance of these units was prepared. It was suggested that the manual would be of sufficient value to be published, and it is presently being revised for this purpose.

To provide onsite analytical services for the field work carried out as part of a two-year study on the Ottawa River, the large 44 ft. x 12 ft. mobile laboratory was established on a site at Carleton University. Operation was continued for the period May to September and was entirely successful in the first year of operation.

The laboratory participated in a number of analytical reference studies as a member of three organizations in this field: The IJC Methodology Committee, The U.S.P.H.S. Analytical Reference Service, and the British Water Research Association Inter-Laboratory Testing of Analytical Methods. The latter two organizations initiate studies not only of current methods but of promising new techniques. Analyses studied have included anionic detergents, iron, fluorides, and, currently, a study on a number of methods for the analysis of various chemical forms of nitrogen and phosphorus.

A reorganization of reporting procedures, continued through the latter half of the year, achieved completion of analytical tests on all incoming samples within a maximum time of three weeks of their arrival at the laboratory.

Great Lakes Laboratories

During the year, the Division of Laboratories continued to maintain laboratory facilities in London and Toronto in order to provide for the needs of the IJC Great Lakes Project. Due to the fact that the parameters being measured in the Great Lakes Program are of extremely low concentration and are perishable in nature, it is of the utmost importance that the analyses be conducted as speedily as possible. A new technique was adopted during this year's sampling program whereby the samples were frozen on board the boats and transported to the shore laboratories in a frozen condition. Since the freezing process inhibits the decay of the sample constituents, enabling the laboratory to temporarily store the samples when necessary, the laboratory staff were able to accept, when occasion demanded, a higher daily sample input than would otherwise have been possible. A secondary benefit which resulted from the adoption of the sample freezing technique was the more efficient use of the laboratory analytical facilities by providing a steady controlled work input for the laboratory staff.

As was the case in previous years, all the analytical data generated by the Great Lakes Program were again reported in a format suitable for computer storage and retrieval.

The number of Great Lakes samples analyzed totalled 8,066, a 22% reduction over the previous year's total. Tests performed totalled 84,919, a 16% reduction compared to 1967. The levelling off in sample input enabled the staff to devote more time towards improving the accuracy and precision of the analytical results by instituting more stringent quality control programs.

The London field laboratory also performed an additional function in analyzing regional samples

which otherwise would have been processed at the main laboratory in Toronto. The number of regional samples received in 1968 totalled 3,050, compared to 2,024 the previous year. Tests performed amounted to 13,724, an increase of 3,724 over the 1967 figures. The increase resulted from a planned build-up in the number of samples diverted to the London operation, in line with the Division's policy to sustain an orderly growth of the regional function.

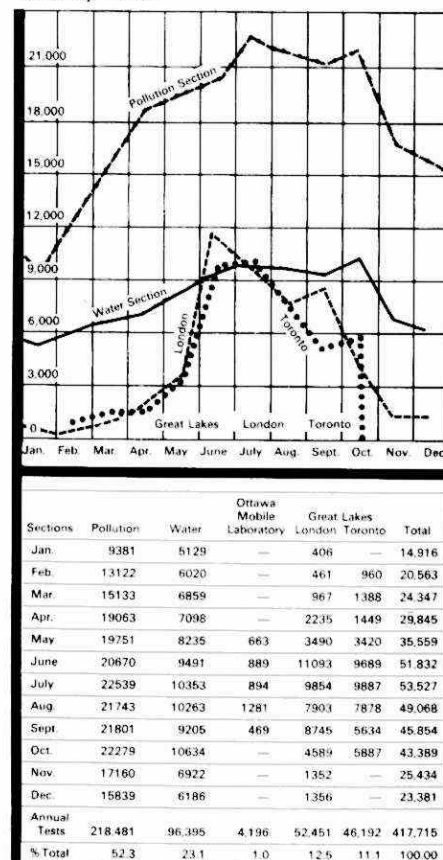
Special Projects

Members of the laboratory staff who represented the Commission on the IJC Methodology Committee, continued with the program, introduced during 1966, of preparing and distributing standard samples among the Canadian agencies engaged in Great Lakes work. The purpose of this co-operative study is to assess the merits of the analytical procedures being used by the participating agencies and to establish whether the laboratories are obtaining comparable results. The results of this year's study indicated that the Commission laboratories were maintaining a satisfactory level of accuracy with respect to the analytical work performed.

Laboratory staff co-operated with the OWRC Great Lakes Project Engineer in planning an intensive sampling survey of the western basin of Lake Erie in order to investigate the eutrophication problem which exists in the lake. The report on the survey findings discusses the probable causes of the eutrophication problem and examines ways in which the eutrophication process could be slowed down in the lake.

In line with the Commission's policy of establishing regional facilities in order to better service outlying areas of the Province, property was rented in Fort William during the latter part of the year for a combined office and laboratory complex. Staff from

Fig. 7
Water and Sewage Analysis
Section Tests Totals
Monthly—1968



the main laboratory in Toronto will be transferred to the Fort William operation in the spring of 1969, and the laboratory will become operational in May 1969.

CHEMISTRY II BRANCH

The year 1968 was one of considerable and gratifying progress for the Chemistry II Branch. The noteworthy increase in output (see Figure 8) was associated with a continuous broadening of the capabilities of the laboratory, in response to the increased requirements of modern industrial waste control. While there was little change in the number of samples submitted for analysis, there was a pronounced increase in the number of tests requested, indicating the increased need of other divisions for analytical support. This increasing need also manifested itself in the diversity of analytical work requested, a diversity that often required the development of entirely new methods and techniques.

The large number of analyses performed, over 28,000, represented an increase of 33% over the figure for last year. The Branch was not only able to cope with this large increase, but also managed to extend its capabilities into completely new areas of analytical work.

The relocation and reorganization of both industrial wastes and organic laboratories after the renovations were complete in June vastly improved the layout of the laboratory and permitted the formation of specialized groups which could perform their tasks much more efficiently. New equipment was another important factor in the extension of Branch capabilities.

Special efforts were made to improve the quality and reliability of tests performed by the Branch. At the present time, nearly all tests are performed in dupli-

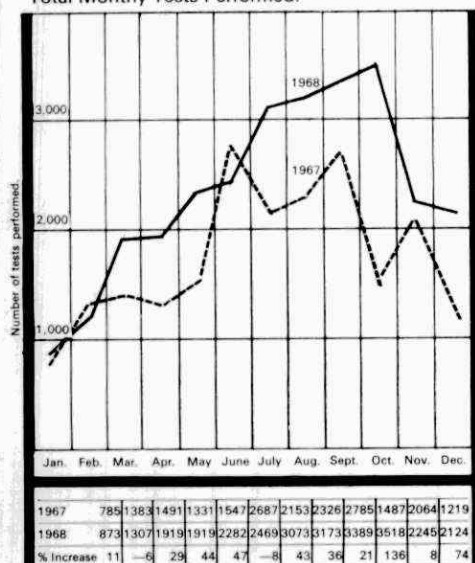
cate or triplicate and, quite often, two different techniques are used to assure that all results reported are accurate to the required limits. Since alternate methods are now available for most determinations, it is possible to select the most suitable one according to sample type, expected concentration, and possible interferences.

In the inorganic laboratory, nearly all tests are now carried out with modern instrumental techniques (atomic absorption, polarography, or spectrophotometry), the atomic absorption spectrophotometer carrying the bulk of the load. With these techniques, most of the heavy metals can be determined with greater accuracy and speed than was possible with previous standard procedures. The next task is to extend such techniques to the determination of toxic anions, such as cyanide and arsenic.

In the organic laboratory, the addition of the fraction collector and a routine gas chromatograph made it possible to isolate and determine some individual organic pollutants. Improvements were made in the sampling technique using the carbon adsorption unit, and five stations were maintained on the Great Lakes which sampled organic micropollutants from Sarnia to Kingston on Lake Ontario. Another unit will be installed in the vicinity of Cornwall to complete the coverage of the two lower Great Lakes basins. A report covering a one-year period of carbon adsorption unit operation has been prepared for both the Great Lakes and for a station at Brantford. An important finding of these surveys was that the carbon chloroform extract (CCE) values found did not exceed the OWRC drinking water standard at any of the sampling points investigated.

A new technique to determine organic pollution has been initiated by purchasing a Beckman Carbon Analyzer. The determination of organic carbon by this technique provides a fast and accurate way of

Fig. 8
Total Monthly Tests Performed.



evaluating the carbon content of waters. Investigations were begun to determine the relation between this new parameter and the conventional BOD and COD values. This technique will facilitate the determination of efficiencies in waste treatment procedures and will be a help in assimilation studies, as well as in general organic pollution control.

Members of the Branch participated in the work of the Great Lakes Committee and the UniRoyal Committee. The branch staff also had the opportunity to present two papers concerning developments in analytical techniques, and were involved in too international studies of analytical methodology.

Division of Plant Operations

D. A. McTavish, Director

C. W. Perry, Assistant Director

The Division of Plant Operations supervises the operation of all water and sewage works financed and constructed by the Commission. By the end of the year, there were 313 projects operating in 192 municipalities and 7 industries (municipal : 126 water, 179 sewage ; provincial : 5 water, 3 sewage). A total of 285 operators were on staff at the year end.

ADMINISTRATION

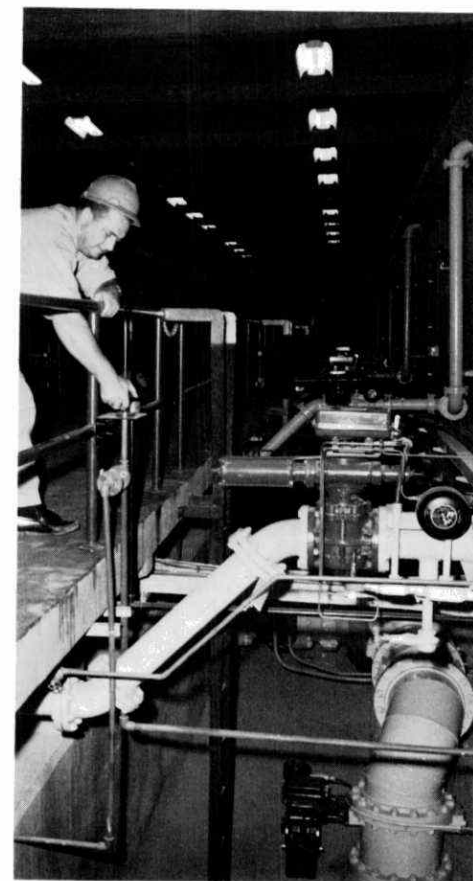
The Division becomes involved in each project during its design stages. Reports, plans and specifications submitted by consulting engineers are reviewed by the Division, in conjunction with other divisions, to ensure the provision of suitable works.

For purposes of administration, the Province is divided into six regions, projects in each region being the responsibility of a regional operations engineer. The latter prepares estimates of the operating costs, determines staff requirements, and maintains liaison with local officials. He also ensures that adequate preventive maintenance of equipment is practised, and that the process provides the maximum possible treatment.

A maintenance section, consisting of mechanical and electrical technicians and technologists, assists the operations engineer in establishing adequate maintenance programs. A project services section, including a statistical group, assists in process problems and maintains data on the operation.

The operations engineer reports to a supervisor, who, by participating in the development of the policies established at divisional level, ensures a high standard of operation.

Major provincial works are supervised by engineer-managers, who ensure that adequate maintenance programs and process control are pro-



vided. They are also responsible for initiating expansion programs, and establish and maintain communication with present and prospective participants.

PROJECT SERVICES SECTION

The project services section investigates field operating problems, evaluates operating results, appraises new chemicals and processes, reviews plans and specifications for new projects, prepares yearly summary reports on process operation and prepares special reports. The project services engineer also supervises the activities of the Division's statistical and brochures sections.

During the year, papers were prepared and presented at the Chief Operators' Conference and at the Sewage Works Operators' Course. Summary reports were prepared on the operation of water pollution control plants, water treatment plants and waste stabilization ponds operated by the Division.

Polyelectrolyte trials were conducted at the Preston and Brantford Water Pollution Control Plants with a view to determining whether the present coagulating agents, lime and ferric chloride, could be replaced when conditioning the sludge prior to vacuum filtration. However, the results indicated that, at present, the polyelectrolytes were not suitable for vacuum filtration at these plants. Polyelectrolyte flocculation of raw sewage was attempted at the Waterloo plant during the first part of the year but was unsuccessful because of the existing hydraulic conditions. A long-term, full-scale test of polyelectrolyte flocculation of raw sewage was initiated at the Lakeview plant in the latter part of the year.

The training of laboratory personnel in the field is conducted under the supervision of this section. An inspection program has been designed to assess techniques and facilities in Commission-operated laboratories.

A detailed report assessing the operating problems at the Southampton Diatomaceous Earth Filtration Plant was prepared. Work will be continued in 1969 to improve the operation of the plant.

TECHNICAL SERVICES SECTION Maintenance

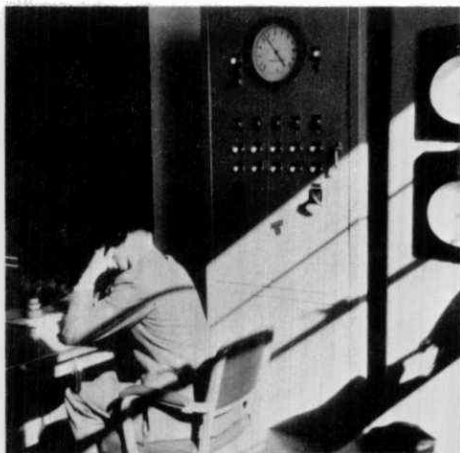
High standards of maintenance and a preventive maintenance program protect the Commission's capital investment and ensure continuity of treatment processes at all projects.

The technical services section—a group of highly-trained specialists reporting to an experienced mechanical engineer—is responsible for this phase of the Division's activities. The section's main functions are inspections, supervision, training, troubleshooting and the up-grading of the Division's preventive maintenance program and procedures at all projects.

Maintenance assistance and the establishment of project maintenance is provided by the regional maintenance technician who reports to the technical services section for guidance in technical matters, but is responsible to the regional operations engineer for project equipment evaluation.

Equipment Evaluation

The priority program and the revised system of reporting past performance, maintenance data and operating information form the basic source of information for the evaluation of equipment. Electronic data processing equipment, using this information, will offer valuable assistance in selecting materials and equipment in the future, and in preparing specifications for this material and equipment.



Safety

The safety program was continued at all projects. Training programs in fire-fighting, first-aid, and the problems associated with the servicing and maintenance of gas-producing equipment were emphasized.

Liaison with the Department of Energy and Resources Management consisted of a reciprocal arrangement whereby employees of the Department and the Commission attended each others' courses.

A paper was presented to the Canadian Institute on Pollution Control. An award of progress was presented to the Commission by the A.W.W.A. for safety progress in 1967.

There were no fatalities or permanent injuries to any of the Commission plant staff during the year.

The following comparative table for the years 1963 to 1968 shows disabling injuries, frequency and severity rates of accidents:

Year	Disabling Injuries	*Frequency rate	**Severity rate
1963	6	17	180
1964	11	25	440
1965	13	33	351
1966	14	26	256
1967	9	17	260
1968	22	37	724

*Frequency Rate—Disabling injuries per million man-hours worked.

**Severity Rate—Man-days charged to disabling injuries per million man-hours worked.

Region I

Forty projects were in operation during 1968 in Region I. Five are water treatment plants and 12 are water pollution control plants. The balance of the projects are either water distribution systems or sewage collection systems. Construction proceeded at one project in Wallaceburg, Kent County.

Enlargements were at various stages of planning for the Union Water System, the Colchester-Harrow water system, the Dresden Water Plant, and the Tillsonburg Sewage Plant.

Thirty-four new projects were at various stages of development as Provincial projects.

Region II

Forty-three projects were in operation during 1968; of these, 13 were treatment facilities and the remainder consisted of distribution or collection facilities. One report on expansion of existing facilities was initiated during the year and one report was received on the Brantford Water Pollution Control Plant, dealing with modifications to plant facilities.

Arrangements for enlargement of the Burlington Skyway plant were completed, and construction is expected to start early in 1969.

Eleven projects were at various stages of development under Provincial ownership.

Region III

Forty-three projects were in operation during 1968, twenty of which were treatment facilities and the remainder distribution or collection systems.

The Mitchell, New Hamburg and Waterloo projects, which were under expansion, were completed in 1968.

Plans have been initiated to expand the facilities at the Georgetown, Fergus, Preston, Listowel and Galt projects.

Region IV

Seventy-eight projects were in operation during 1968. Of these, 27 were sewage and water treatment facilities, 13 were well installations and the remainder were collection or distribution systems.



New wells were completed in Oak Ridges, Schomberg, Stayner and Tara. The Provincial sewage projects at Ear Falls, Beeton and Woodbridge were completed in 1968.

The sewage treatment facility at Markdale was completed and came into service in August.

The expansion of the Orangeville plant was completed in November.

Operative agreements have been entered into in Midland and Fort Frances to operate municipally-owned sewage pumping stations.

Region V

There were 37 sewage and 30 water projects, for a total of 67 projects in operation during 1968.

Forty-seven of these projects represented treatment of pumping facilities requiring regular supervision on either a full-time or part-time basis. The remainder of the projects represent either water distribution or sewage collection facilities. Eleven waste stabilization ponds were in operation during the year.

Engineering reports were completed for expansion of existing facilities at Coniston and Newcastle. A request to expand the facilities at the Richmond Hill plant was received from the Town. Construction commenced on the extension to the existing secondary treatment plant in the Village of Markham. Extensions to the Township of Markham Water Supply System were completed. New projects were put into operation in Moosonee, Haileybury, Port Perry, Township of Mountjoy and the Big Bob River Water Supply System in Bobcaygeon.

Region VI

In 1968, a total of 34 water and sewage treatment facilities were in operation. The projects consisted

of 17 small water treatment plants, ten waste stabilization ponds, three primary treatment plants, three activated sludge sewage treatment plants, and one trickling filter treatment plant.

The Cornwall Sewage Treatment plant was put into operation in late December, 1968. This facility consists of a pumping station of 20 MGD capacity and a primary treatment plant of 7.5 MGD capacity.

Two small water treatment plants were enlarged in 1968. Final construction drawings were completed for one new activated sludge treatment plant and the enlargement of one primary treatment plant to secondary treatment.

A financial proposal was submitted to the municipality of Almonte for the extension of the lagoon system to handle the industrial waste loading. Another engineering report was received for the enlargement of the Alexandria waste stabilization pond.

Engineering reports are being prepared for the enlargement of one primary treatment plant for the enlargement of one secondary treatment plant and for the modifications of one trickling filter plant.

There was a total of ten engineering reports received in the region, with plans for initiating a Provincially-owned project.

Division of Project Development

P. G. Cockburn, Director
L. F. Pitura, Assistant Director

The Division of Project Development is responsible for facilitating the development of municipal sewage and water works projects under Section 39 of The Ontario Water Resources Commission Act and for the development of Provincially-owned sewage and water works facilities for municipalities under Sections 16a and 16(1)d of the OWRC Act. The Division is divided into three branches: Administration Branch, Projects Branch and Property Branch. The Administration Branch directs and co-ordinates the activities of the Division. Details concerning the duties and the work completed in 1968 by the other two branches are given later in this report.

During the year, an increasing number of municipalities requested information on the methods available through the Commission for the provision of sewage and water works. While the majority of requests were from smaller municipalities, the most significant accomplishment during the year involved the successful execution of agreements with municipalities in several large regional programs. It is expected that this recent increase in the number of requests for projects will level off in the coming year and, subsequently, stabilize at a more regular rate of growth. Indications are, however, that yet more municipalities are interested in pursuing the possibility of the Commission acquiring their existing facilities in order to relieve their indebtedness.

PROJECTS BRANCH

The Branch is responsible for developing (a) OWRC/municipal sewage and water projects, and (b) Provincially-owned sewage and water programs. The development of new OWRC/municipal projects remained at about the same level as the previous years. The workload with respect to Provincially-

owned programs increased considerably since many of the 1966 and 1967 programs reached the stage where firm proposals, including agreements, were presented to many municipalities. The statistics and details pertaining to each type of project development follow:

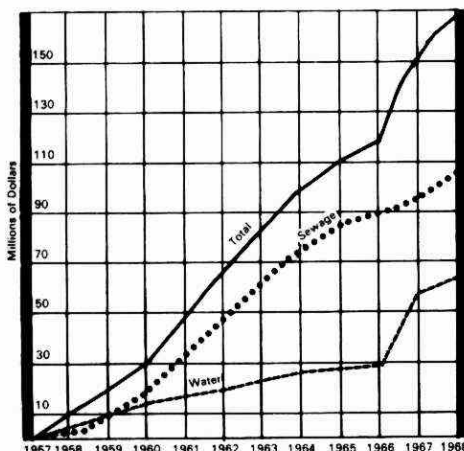
(a) Municipal Projects

During the year, 21 municipal projects were accepted by the Commission, consisting of 14 sewage projects at a total estimated value of \$6,989,719, and 7 water projects at a total estimated value of \$1,664,800. A tabulated summary of the development of municipal projects follows.

1968	New Proj. Requ.	New Proj. Accept.	Prel. Agmts. Exec.	Fin. Agmts. Exec.	Rating Props. Prep.	Fin. Statem. Prep.	OMB Note. Prep.	Hear.
Jan.	3	1	—	5	2	2	6	—
Feb.	2	—	1	2	—	2	4	—
Mar.	5	—	3	3	3	1	1	2
Apr.	3	3	1	3	1	—	2	—
May	4	4	2	5	—	3	—	—
Jun.	4	3	—	6	3	4	1	—
Jul.	2	4	2	2	3	3	4	2
Aug.	1	1	2	2	3	3	1	—
Sept.	3	4	1	2	—	3	1	1
Oct.	1	—	—	2	3	4	—	—
Nov.	3	—	1	4	—	4	1	—
Dec.	5	1	2	1	2	—	—	—
Totals								
1968	36	21	15	37	20	29	21	5
1967	27	31	23	22	33	30	25	12
1966	29	26	28	30	32	27	24	9
1965	35	33	31	35	34	27	26	15

Although no marked increase occurred in the number of projects developed, there was a continuing difficulty in establishing equitable rating structures because of the high construction costs for most projects.

Fig. 1
Cumulative Capital Costs
Projects in Operation





(b) Provincial Programs

There were 233 programs in various stages of development during the year. These consisted of 160 sewage works programs at an estimated value of \$144,000,000 and 73 water works programs at an estimated value of \$38,000,000, totalling \$182,000,000 as compared to \$141,500,000 at the end of 1967. The above figures do not include regional programs which are reviewed later in the Branch report.

A tabulation of pertinent statistics related to the development of the program is provided below.

STATISTICS—PROVINCIAL PROGRAMS

	1967	1968	Cumulative Total
Applications Received for Sewage Works.....	65	37	190
Applications Received for Water Works.....	26	23	78
Provincial Programs Accepted by Commission.....	86	46	233
Engineering Agreements Executed for Retaining Consulting Engineers (Design Report).....	40	55	165
Municipalities Participating in the Provincial Programs (Excluding those Municipalities Involved in Regional Studies).....	70	32	211
Reports Received from Consulting Engineers (Draft, Preliminary, Final Design).....	73	47	184
Tentative Rates Approved by Commission.....	51	68	156
Agreements for Final Design Executed.....	12	17	31

The above statistics confirm that the majority of programs are now reaching the stage where rates are being accepted by the Commission and subsequently transferred into a form of a proposal to the

municipalities. By the end of the year, approximately 65 per cent of the total programs had reached this stage compared to only 33 per cent at the end of 1967.

(c) Regional Programs

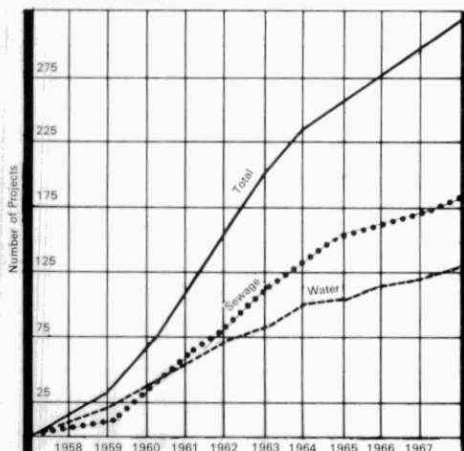
Regional programs have been separated from the above category because of their special conditions and extensive areas of proposed servicing with water or sewage works. Because some of the programs involve as many as five municipalities, co-ordination and development of the proposals present a considerable challenge. The advent of more regional governments may have a pronounced effect upon these schemes as they are based more on service to an area rather than to an individual municipality. During the year the Commission made significant advances in this particular activity as agreements were executed for several extensive schemes. The most notable of these was consummation of agreements with five municipalities in the Southern Peel County Area, which will require an estimated outlay of \$88 million over the next 20-year period for sewage and water works in the area. However, it is also significant that six regional programs are being held in abeyance because the municipalities involved indicated that they were not in favour of the further development of the programs.

A brief report on each regional program being developed at the end of the year follows:

AMHERSTBURG-ANDERDON-MALDEN AREA WATER SUPPLY SYSTEM

The agreements were executed with the municipalities and the final design was well advanced. Construction was scheduled for early 1969.

Fig. 2
Projects in Operation
Cumulative Total



BLEZARD VALLEY AREA WATER SUPPLY SYSTEM

An application was placed before the Ontario Municipal Board requesting approval for the execution of the agreements. Proposed amalgamations among the participating municipalities may affect the program's development.

SOUTHERN KENT COUNTY AREA WATER SUPPLY SYSTEM

The City of Chatham agreed to a proposal for the supply of unfiltered water and, at the end of the year, an application was before the Ontario Municipal Board requesting approval of the undertaking. The development of the proposal, including the supply of filtered water to several other municipalities including the Town of Blenheim, was dependent on an indication of participation from that Town, but this had not been received by the end of the year.

KINGSTON AREA WATER SUPPLY SYSTEM

A proposal for supplying filtered water to four municipalities was submitted near the end of the year.

WESTERN LAMBTON COUNTY WATER SUPPLY SYSTEM

As a result of requests received from the municipalities of the Sarnia area, arrangements were initiated for a formal Commission Hearing to be held early in 1969.

LAKE TIMISKAMING WATER SUPPLY SYSTEM

The agreements were executed with the municipalities for the supply of filtered water and the final design was near completion. Tenders for construction were scheduled for advertising in the spring of 1969.

LINCOLN COUNTY AREA SEWAGE WORKS SYSTEM

An application was submitted to the Ontario Municipal Board requesting approval for the execution of the agreements with the municipalities. In addition, a report on trunk sewers requested for the area was completed by a consultant and was under review at the end of the year.

SOUTHERN PEEL COUNTY AREA WATER AND SEWAGE WORKS SYSTEMS

Agreements were executed with the five participating municipalities late in December.

CENTRAL YORK COUNTY AREA WATER & SEWAGE WORKS SYSTEM

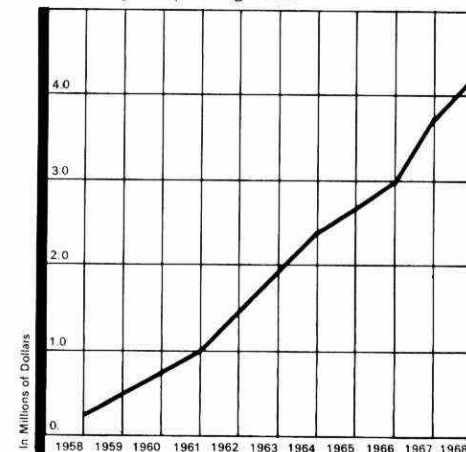
A tentative proposal was prepared and arrangements reviewed for the presentation of the proposal to area municipalities.

PROPERTY BRANCH

The number of property acquisitions decreased slightly during the year. During the early part of 1968, a number of municipal projects were converted to Provincial programs with a consequent postponement of land acquisition. However, during the latter half of the year, as these programs came into effect, the number of property acquisitions increased sharply.

The Property Branch now becomes involved in Provincial sewage works programs at an earlier stage, following a decision by the Commission to inspect all property and prepare a preliminary report prior to the Information Hearing. The Branch was also assigned the responsibility of advising owners and interested parties of the Information Hearing. A total of 48 preliminary property reports was prepared during 1968.

Fig. 3
Total Project Operating Costs



Division of Research

A. J. Harris, Director

The Division of Research is responsible for the systematic investigations of methods, processes and practical theory pertinent to the control, management, and treatment of water and wastewater. Such investigations are carried out by experimental methods involving models, pilot plants and full scale field trials.

Formal research publications are prepared for those research projects considered to have wide general interest and are distributed to individuals and organizations.

Technical support is provided to the other divisions of the Commission and through them to municipalities in overcoming operating problems pertaining to biological and chemical waste treatment facilities, in evaluating and/or analyzing existing processes and equipment, in obtaining the optimum results from a treatment process for specific wastewaters, and in laboratory procedures and analytical techniques for optimum plant performance.

The Division is organized into three branches, namely the Applied Sciences Branch, the Technical Advisory Services Branch, and the Special Studies Branch. Their activities are detailed in the following pages.

APPLIED SCIENCES BRANCH

The Applied Sciences Branch carries out relatively long-term studies of engineering-oriented problems in the water supply and waste treatment field. Projects undertaken normally result from direct requests from other divisions within the Commission for information on problems which they have encountered. A qualified staff with training and experience in various branches of the engineering field, particularly with application to water pollution control and abatement, renders the Branch capable of a wide variety of work.

The diversity of this work is apparent from the

Of the three large Provincial regional programs undertaken to date, work was completed on the Lake Erie Water Supply System during the year, with the exception of the reservoir site. In conjunction with the Division of Construction, a program was initiated to finalize all properties on the Lake Huron Water Supply System following completion of remedial drainage works. At the year's end, 90 per cent of the properties had been finalized. Following the execution of the agreements with municipalities in the Southern Peel County Area Provincial programs in December, 1968, work commenced on the valuation of assets to be transferred to this Commission.

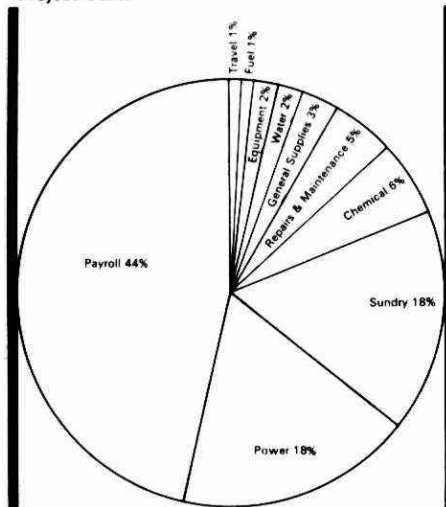
With the passing of The Expropriations Act, 1968-69 on December 20, 1968, a review of Commission procedures was undertaken to determine the effect of the new regulations. The most significant sections of the new Act are those which lengthen the time between the decision to expropriate and the entry on the lands. This will extend the period from the four to five weeks previously applicable to a period of five to seven months as a minimum.

The statistics for the Branch were as follows:

STATISTICS

PROPERTIES	1966	1967	1968
Properties under negotiation at end of previous year	53	35	37
New properties listed for acquisition during previous year	57	257	155
Options obtained or property otherwise acquired	75	255	122
Properties under negotiation at end of year	35	37	70
OPTIONS			
Options held at end of previous year	281	168	115
New options acquired during year	67	124	122
Transactions completed during year	180	177	89
Options outstanding at end of year	168	115	148

Fig. 4
Distribution of Annual
Project Costs



following brief descriptions of the projects with which the Branch was involved during 1968:

Table 1		Research Publication	
	Projects Carried Over	Projects Completed	Report No. Paper
1	66.12 Gravity filtration of algal suspensions	x	21
2	67.2 Cladophora Control	x	
3	67.2 Biodegradability of Potato Processing Wastes	x	2013
4	67.5 Subsurface aeration systems	x	5001
5	67.7 Pilot Oxidation Ditch	x	2014
6	67.8 Zeta Potential Study		
7	67.11 Farm Animal Waste Disposal		28
8	67.13 Control of Flowing Artesian Wells	x	2020
9	67.14 Water Plant Sludges	x	29
10	67.16 Ultraviolet Disinfection		
<u>New Projects Started</u>			
11	68.1 Reverse Osmosis		
12	68.2 Chlorine Exchange Resins		
13	68.3 Aerobic Digesters		
14	68.4 Frazil Ice		
15	68.6 Thermal Pollution Studies		
16	68.8 Lake Eutrophication		
17	68.9 Chemical Treatment of Domestic Sewage		
18	68.10 Gamma Irradiation of Sewage and Sewage Sludges		
19	68.11 Treatment of Uranium Wastes		
20	68.13 Icing of Mechanical Aerators	x	2018
21	68.17 Chemical Oil Dispersants	x	2019-2020
	Oil Sweeper	x	memo
	Seacock Filler	x	memo
22	68.18 Chemical Sealants	x	memo

Treatment of Liquid Wastes from Uranium Milling Plants

The Branch staff has been requested to conduct investigations into the problems associated with the disposal of liquid wastes discharged by uranium milling plants. These problems concern the effects of tailings pond effluents, with high level of chemical contaminants, on the water quality in the receiving streams and the phenomenon of depressed pH conditions occurring in the tailings pond area. The investigation is continuing.

Ultraviolet Sterilization

As a follow-up to the literature survey of the practice of ultraviolet sterilization, a small UV water purifier, sold commercially for the purification of small potable water supplies, was secured for evaluation purposes. The unit was subjected to rigorous laboratory tests in order to study its limitations and other factors that may affect its treatment efficiency.

Chemical Sealants

Two samples of sealing compounds commercially available for plugging leaks in concrete walls of water reservoirs were examined for their toxicity to fish. The results of these tests were presented in a memorandum report.

Chlorine Exchange Resins

Chlorine exchange resins were investigated for their possible application to the chlorination of small

water supplies and sewage. These materials, synthesized and developed at the University of Toronto, are a series of nitrogen-containing polymers which are capable of picking up chlorine from a chlorine-rich aqueous system and releasing it to another aqueous system with a chlorine demand or which is deficient in chlorine. The result of this investigation showed that these resins offer interesting possibilities but the lack of technology in controlling their reaction mechanisms with chlorine, as well as economics involved, would limit their practical use at the present time.

Chemical Oil Dispersants

Since the shipwreck of the super oil tanker "Torrey Canyon" off the English coast early in 1967, there has been considerable interest in finding suitable methods to clean up accidental oil spills. Several chemical additives have been developed and introduced on the market. Many of these are oil dispersants and emulsifying agents, and are claimed to be very effective, biodegradable and non-toxic to aquatic life.

Five of these chemicals sold as oil dispersants were examined under laboratory conditions to compile some background data with respect to their effects on water quality and aquatic life should they be used excessively or in a careless manner.

Oil Sweeper Invention

An oil sweeper was investigated at the request of its inventor. This was a mechanically-operated device. It demonstrated its capability in removing a floating oil slick by skimming. A report prepared after the investigation indicated that it had some interesting possibilities.

Seacock Fillers

A report dealing with tests on materials sold as seacock filler was prepared. Seacock filler, a very thick grease-like material usually formulated from petroleum derivatives, is used to winterize ships during the lay-up periods on the Great Lakes. Its primary function is to protect the valve and intake systems of the ship against damages due to freezing. In the spring, this material is usually eliminated by overboard discharging and this practice has evoked numerous complaints in the past.

Water Plant Sludges

A survey of literature was undertaken to review the current methods and problems associated with the handling and disposal of sludge and waste by-products derived from all types of municipal water purification plants, including those employing chemical coagulation and filtration, diatomite filtration, iron removal and water softening processes. The results of this survey were reported in Research Publication No. 29.

Zeta Potential Study

Studies are continuing on the application of zeta potential data to chemical purification of difficult waters and wastewater. During the year, a "Zeta-meter", an instrument for measuring zeta potentials, was acquired.

Reverse Osmosis

Preliminary investigation has been started on the possible application of membrane filtration or reverse osmosis in water pollution control. Reverse osmosis is a process or technique in which dissolved constituents in a solution, whether it be solids in liquid, liquid in liquid, or gas in gas, can be separated by the use of a semi-permeable membrane.

Thermal Pollution Studies

A number of power generating stations are planned for the Great Lakes region over the next few years, all of which will discharge vast amounts of heated water into lakes and rivers. It is necessary that an overall review and appraisal be undertaken of possible beneficial and harmful effects of heated discharges on the environment.

The Application of Subsurface Aeration Systems to Waste Stabilization Ponds

Since many waste stabilization ponds become overloaded at some stage of their operating life, an evaluation of some subsurface aeration systems was made to determine whether they might provide a solution to this problem.

Gamma Irradiation of Sewage and Sewage Sludges

When Atomic Energy of Canada, Limited, showed interest in developing means of treating sewage by gamma irradiation, a program was undertaken to determine the feasibility of such treatment. Two Gamma cells supplied by AECL provide Cobalt-60 sources of different strengths. Static and dynamic tests are being carried out to determine the effects of gamma irradiation on the settling of sewage and sewage sludges, and on various stages of biological and chemical treatment processes.

Gravity Filtration of Algal Suspensions

The purpose of this study was to determine the effectiveness of various filter media in removing algae from water supplies and the extent to which these media clogged. Suspensions of green algae and the flagellate *Euglena* were filtered through

media consisting of various combinations and depths of sand and anthracite at various flow rates. In general, removal of the algae by the filters was poor.

Frazil Ice

A study of the occurrence and prevention of the formation of frazil ice in surface water intakes was undertaken, based on information obtained from published material and on data obtained from a survey of experiences at water plants in Ontario. This study will provide advice to water authorities in Ontario on the action to be taken to alleviate these problems, and it will also aid in the review of new intakes.

Aerobic Digestion

An evaluation of the aerobic digestion process was undertaken in the form of both a literature review and a laboratory study, because of the increased use of aerobic digesters as sludge disposal facilities. Since these units rarely are covered or heated, their performance during cold weather operation is being studied.

Control of Flowing Artesian Wells

Following a literature survey, a paper has been prepared describing the various methods and problems involved in controlling the leakage of water from wells under artesian conditions. Rehabilitation of such wells is not a simple matter and generally such operations are both time-consuming and expensive.

Icing of Mechanical Aerators

At the request of the Division of Plant Operations, a paper investigating the icing problems associated with surface aerators on lagoons in Ontario's northern climate was prepared. The paper concludes that "there is no reason to believe that, except under

the most extreme conditions, icing of mechanical aerators should become an insurmountable problem in the operation of aerated lagoons in the northern Ontario climate".

Chemical Treatment of Domestic Sewage

This project was initiated to investigate a chemical process to remove BOD, suspended solids and phosphorus from domestic sewage in a single unit reactor. Removal of nitrogen may be conveniently accomplished in a second step. The process studied involves a combined flocculating-settling basin, employing mechanical mixing. The chemicals used are lime and ferric chloride.

Lake Eutrophication

This study was established to complement the chemical treatment projects. Existing technology indicates that near-complete removal from wastewaters of nitrogen, phosphorus and/or carbon is economically feasible. The eutrophication study is designed to determine which of these nutrients, if removed, may limit algal production in a specific watershed: This information is paramount to a eutrophication control program

Farm Animal Waste Disposal

Following the preparation of Research Publication No. 28, the Division has been keeping abreast of farm animal waste treatment and disposal methods employed throughout the Province of Ontario, as well as current research work in the United States and elsewhere. Several meetings have been attended, and papers have been presented on two occasions by Research personnel.

Pilot Oxidation Ditch

A paper presenting design and operating data on a prefabricated oxidation ditch to be used in pilot scale studies was prepared from work carried out in late 1967.

Biodegradability of Potato Processing Wastes

A paper presenting the results of pilot-scale studies investigating the treatability of potato processing wastes was completed. Design and operating data for full scale operation are presented.

Cladophora Control

A paper outlining the Commission's investigations of the use of algicides for the control of nuisance *Cladophora* was presented at the Eleventh Conference on Great Lakes Research in Milwaukee. The paper indicated that of 67 chemicals screened for *Cladophora* control by the Biology Branch, Division of Laboratories, and the Division of Research, none has been found to be entirely satisfactory in field application. It was recommended that, until such time as a manufacturer can demonstrate to the Commission's satisfaction the effectiveness of a chemical, further evaluation of algicides for this purpose should be suspended.

TECHNICAL ADVISORY SERVICES BRANCH

The Branch continued to work closely with the divisions of Industrial Wastes, Plant Operations, Sanitary Engineering and Water Resources. Through these divisions the facilities of the Branch are available to all municipalities, particularly those encountering difficulties in the operation of their

water and waste treatment plants.

Assistance has been provided to the Division of Sanitary Engineering in the form of review and comments on the design parameters of Provincially financed plants and, in a similar manner, to the Division of Industrial Wastes within its operating area. In many cases, pilot plant studies have proven to be a necessary adjunct to this service.

Wastewater Treatment

The nature of the work carried out during the year changed considerably from that performed in previous years. There has been a shift in workload from equipment evaluation to the analysis of existing biological processes and the development of techniques to assess both the applicability and performance of activated sludge systems for treating various wastewaters.

In conjunction with the Division of Plant Operations, an intensive research study on the use of short-term aeration in the activated sludge process was carried out at Newmarket. This study involved successful full-scale operation of an activated sludge system featuring aeration periods of considerably less duration than those conventionally used. At the request of this Division, tests performed on coarse bubble diffusers, under process conditions at both Brantford and Tillsonburg, confirmed the oxygen transfer efficiencies previously determined using tap water as test media.

At the request of the Division of Industrial Wastes, an intensive study was carried out on specific installations of a combined type treatment system featuring the aeration basin, settling section and polishing lagoon combined into one large basin. The study concluded that, while oxygen transfer capacities were considered satisfactory, these

systems suffered from insufficient mixing capabilities.

An evaluation of the extensive waste treatment facilities serving a potato processing industry was performed also at the request of the Division of Industrial Wastes. In cooperation with that Division, extensive assistance was provided to several industries carrying out treatability studies using bench-scale activated sludge plants. Laboratory studies were also conducted to determine the effects of particular industrial wastes on the activated sludge process before recommendations could be made that such wastewaters be discharged to sanitary sewers. One unique waste proved unacceptable for discharge to the municipal treatment system because of its high copper content. Development is continuing of laboratory techniques that should allow rapid assessment of the biodegradability of particular wastewaters.

Chemical evaluation of waste and waste treatment facilities of a non-biological nature were also investigated. Chemical waste treatment plant facilities at Anaconda Brass Company in Mimico and Canron Limited in Rexdale were evaluated and recommendations made. A foul odour problem at the waste treatment lagoon of the Ford Motor Company of Talbotville was demonstrated to be due to a low level of selenium contaminant from Company operations. The aqueous wastes of General Smelting Company and the Universal Drum Company of Burlington were evaluated for recommendations as to the general procedure of disposal.

At the request of the Division of Sanitary Engineering, studies of two aerated lagoon systems were performed. One system, featuring mechanical aerators, suffered from a lack of solids separation facilities while the other system, equipped with floating aerators, performed adequately. Also at the request of that Division, the feasibility of using tube



settlers for activated sludge solids separation was studied. The preliminary results obtained indicated that further work with this device is warranted. An investigation into the performance of aerobic digesters located in the Province was undertaken.

Water Treatment

Much of the water treatment work during the year dealt with coagulation and filter run performances requiring improvement, and indicated by the divisions of Plant Operations and of Sanitary Engineering. In some cases, however, communities such as Verner, Foxboro, Moosonee and Chapleau required treatability studies to enable an informed selection of new water supply sources to be made. Other municipalities, such as Niagara Falls, Niagara-on-the-Lake, Port Robinson, Township of Thorold and Grimsby, sought assistance in improving their coagulation systems. At Deseronto, a major pilot plant was operated to improve the treatment of Bay of Quinte water beset with threshold odour numbers of 300. Resolving the problem of this water odour would go a long way to resolving similar problems elsewhere in the Province. The use of either potassium permanganate or superchlorination proved the most successful; the cost of an activated carbon filter was prohibitive.

Assistance given to municipalities seeking to upgrade filter performance varied considerably according to need. Port Dover and Huntsville were advised to convert from sand to dual media; a pilot "Waterboy" plant compared dual media and multi-media beds at Belle River. Iron and manganese problems frequently affected filter performance, as did excess carryover from coagulation settling basins. A softening plant at Schomberg was almost incapacitated by excess iron accumulation.

As with the previous year, iron and manganese

contaminants in well waters were major contributors to water supply problems in the Province. A few communities found it advantageous to use polyphosphate materials to control the marginally excessive iron content of their water. Polyphosphate additions at Stratford and Kapuskasing were successful.

An overall study of the heavy metals problem in ground water now appears close to establishing that an excessive silica content in many waters may be responsible for the retention of iron in solution, even after filtration. A parallel interpretation of the laboratory results regarding silica and iron suggested that activated silica could be substituted for polyphosphates in controlling excess water-borne iron in the distribution system. Chemical costs would only be a tenth of those for phosphates and the concern of adding fertilizer values capable of inducing additional algal problems in downstream watercourses would be relieved. It is hoped that a full-scale test of activated silica will be achieved in the coming year.

A number of gas evolution problems from raw well water were encountered. Some, as at Fonthill, were only due to nitrogen but a number of wells in Schomberg and the Township of Vaughan averaged over 50% methane.

Other investigations included a study of ozonation. While ozonation is still more expensive than chlorination, costs may be justified where taste and odour or colour removal also result from its use. Pilot ozonation tests were started on the Belleville water supply as a taste and odour control measure. Future trials may include other examples of taste and odour removal, colour removal and iron precipitation on difficult waters.

The Branch also participated in the Department of Highways salt control program. Salt was shown

capable of releasing hardness ions from certain types of soil resulting in a more indirect form of ground water contamination. Further meetings with the Department are scheduled in the coming year.

SPECIAL STUDIES BRANCH

The Special Studies Branch of the Division of Research is comprised of senior staff trained in aquatic biology, zoology, microbiology and virology, plus associated support staff. It carries out relatively long-term studies in the field of the life-sciences as related to the control of water pollution. Close association and the sharing of facilities with the engineering group within the Division have provided an interdisciplinary environment which has assisted in translating biological data into engineering process designs.

A brief description of each of the major projects carried on during 1968 follows.

1968 Summary

		Projects Completed	Research Publication No. Report	Paper
1	65.4	Projects Carried Over		
		Effects of Acid Mine Wastes on Phytoplankton in Northern Lakes	x	30
2	65.5	Insecticides and Algae: Toxicity and Degradation	x	27
3	66.4	Virus Recovery		2017
4	66.10	Benthos Studies		
5	67.10	Primary Productivity Studies in Eutrophic Hardwater Lakes		
6	67.15	Taste and Odour		2016

Research
Publication
No.
Projects
Completed Report Paper

		New Projects Started		
7	68.5	Nutrient Budget Studies—Bay of Quinte		
8	68.7	Dehydrogenase activity of activated sludge		
9	68.14	NTA Toxicity and Degradation—Algae		
10	68.15	Nutrient Phytoplankton Relationships in Eight Southern Ontario Lakes	x	32
11	68.16	Virus Inactivation		

Insecticides and Algae: Toxicity and Degradation

The toxicity and degradation of three insecticides, DDT, sevin and Malathion, were investigated using algal materials from a nearby waste stabilization pond and pure cultures of *Chlorella pyrenoidosa* in an acid and alkaline pH. DDT exhibited no toxic properties to algae up to a concentration of 100 mg/l and was only slightly degraded. Sevin is toxic above a concentration of 0.1 mg/l and is not altered appreciably in an acid media. Malathion appears to be extensively converted and, although capable of altering the composition of a mixed culture of algae, did not display a persistent inhibitory effect.

Primary Productivity Studies in Eutrophic Hardwater Lakes

This study consists of two parts, one dealing with algal responses at three locations along a suspected trophic gradient in the waters of the Bay of Quinte, and the other with phytoplankton production in Lake on the Mountain. Field and laboratory studies carried out in 1967 and 1968 provide an insight

into algal productivities in relation to nitrogen and phosphorus availability. An interim report on the former and a final report on the latter are now in preparation.

Nutrient Phytoplankton Relationships in Eight Southern Ontario Lakes

In-situ relationships between nutrient availability and algal production were investigated simultaneously in eight lakes of the Trent River drainage basin. Three lakes were found to be oligotrophic, one mesotrophic, and four eutrophic. No difference between lakes was evident with respect to levels of total phosphate, inorganic nitrogen, sulfate or iron. Distinctions between lakes with respect to algal production appeared to be directly related to inorganic carbon (alkalinity) availability. Additives of oxidized inorganic or biodegradable carbonaceous materials to a low alkalinity raw water stimulated algal production.

NTA Toxicity and Degradation—Algae

The possibility of trisodium nitrilotriacetic acid (NTA Na_3) being a nutrient for algae was tested using axenic cultures of *Chlorella pyrenoidosa* grown in a mineral media where NTA Na_3 was the only nitrogen source and in the supernatant of acclimatized activated sludge to which concentrations of NTA Na_3 up to 275 mg/l had been added. In the former experiment NTA Na_3 , at a concentration of 10 mg N/l, promoted more algal growth after seven days than an equivalent quantity of $\text{NO}_3\text{ N}$. Algal growths in the supernatant of sludge plus NTA Na_3 did not exceed an untreated control whereas equivalent nitrogen additions as nitrate were slightly stimulatory.

NTA, a proposed substitute for polyphosphate in

detergent, was thus demonstrated to be capable of providing nutrient for promoting algal growth in receiving waters after passing through an activated sludge sewage treatment process.

Virus Recovery

An investigation of methods for the isolation of viruses from water supplies was continued throughout the year. After extensive testing with a bacteriophage as a test virus, a laboratory-made soluble alginate filter unit appeared to be capable of detecting 5-10 virus particles per litre of water. A commercial filter unit was acquired and its performance with volumes of water up to 4 litres is still under study. Preliminary experiments utilizing the electron microscope to identify viruses isolated with the alginate filters were undertaken in cooperation with the University of Toronto.

Research Paper No. 2017, "Viruses in Water Supplies and their Significance in Pollution Control", comprising a general review of the problem of viruses in water, was published during the year. In addition, a report on the significance of viruses in pollution problems was prepared for inclusion in a report being prepared for submission to the International Joint Commission.

Virus Inactivation

An evaluation of the use of ultraviolet light for the inactivation of viruses in water was carried out. Initial investigations were undertaken in connection with a unit designed for the disinfection of small water supplies, and additional laboratory experiments to study the process in more detail were initiated.

Studies of the effect of gamma irradiation on viruses in water were begun, utilizing a Gamma

Cell 220 supplied by Atomic Energy of Canada Limited.

During the latter part of the year, an animal virus laboratory was set up. For preliminary studies, a continuous line of rabbit kidney cells (RK₁₃ cells) was acquired and maintained; a strain of vesicular stomatitis virus was adapted to it. This virus will be used to augment studies previously carried out with only bacteriophage as an indicator virus.

Taste and Odour in Water Supplies

Experiments were completed to determine the optimum method for the isolation of Actinomycetes, important in taste and odour formation. The results were published in Research Paper No. 2016. The substance thought to be responsible for the taste and odour was produced in bulk in the laboratory and was used to develop and standardize an identification technique using gas chromatography and ultra-violet spectrophotometry. It was also used to evaluate certain control measures. Various field studies to establish normal and nuisance levels of Actinomycete population were completed.

Effects of Acid Mine Wastes on Primary Productivity

The results of this study, undertaken during 1965-67 on three lakes near Elliot Lake, showed that the lack of inorganic carbon limited species diversity in the algae and primary productivity in lakes contaminated by acid mine wastes. Because of the low pH, regeneration of carbon is impeded and carbon is cycled inefficiently, much being lost to the atmosphere. The reduction in primary productivity affects higher trophic levels adversely and delays the removal of radionuclides to the deep sediments of the lakes.

Studies on Bottom Animal Communities as Pollution Indicators in Lakes

Invertebrate communities, composed of over 100 species of sludgeworms, midges, clams etc., were investigated monthly between March 1967 and September 1968 in the Bay of Quinte. Analyses of production and diversity, in relation to the trophic gradient in the Bay, was well underway by the end of the year. The results are to be published in 1969.

Nutrient Budget Studies— Bay of Quinte

This program, initiated early in 1968 and to be completed in 1969, was designed to estimate the input and output, as well as the circulation through water, mud, algae and sediments, of phosphorus and nitrogen in the Bay of Quinte of Lake Ontario. The major feeding rivers and surface waters were sampled weekly during the spring and summer months, and monthly in the fall and winter. The nutrient content of bottom mud, fresh sediment and algae was determined. The final analysis is designed to act as a guide in formulating nutrient-removal programs.

Division of Sanitary Engineering

J. R. Barr, Director

G. R. Trewin, Assistant Director

The programs of the Division of Sanitary Engineering are divided into five main categories: (1) the evaluation of plans of proposed water supply and wastewater treatment installations; (2) the promotion, inspection and supervision of water and wastewater treatment plants in the Province; (3) the study and control of pollution in the waterways of Ontario and the monitoring of water quality in both the Great Lakes and other waters in and bordering the Province; (4) the supervision of plumbing and the control of pollution from watercraft; and (5) the planning of regional water supply and wastewater treatment facilities.

The five programs are organized and carried out by five operating branches. In addition, an administration group directs the Division's activities and provides two staff functions—the planning of the water works program and the sewage works program of the Division.

An important function of the Commission is the holding of public hearings with respect to sewage works. When a municipality intends to install sewage works in another municipality, the Commission, as required under the OWRC Act, must hold a public hearing. In addition, the Commission may hold public hearings before approving sewage treatment works to be located within the municipality to be served or which are to be privately owned and operated. The purpose of the hearings is to ensure that the intended works will not adversely affect adjacent properties. In 1968, a total of 48 public hearings were held concerning the location of proposed sewage treatment facilities. One public hearing covered proposed storm and sanitary sewer installations in adjacent municipalities. Of special note is the fact that 42 of the public hearings concerned Provincial sewage treatment projects.

Of special note during the year was the transfer of four members of the District Engineers Branch to the Commission's new regional office at the Lakehead. The new group, headed by a District Engineer, serves the districts of Rainy River, Thunder Bay and Kenora in north-western Ontario.

DESIGN APPROVALS BRANCH

During the year, the Branch appraised engineering reports, plans and specifications submitted for the approval of water works, sewage works, and certain agricultural waste treatment installations in accordance with Section 30 and Section 31 of the Ontario Water Resources Commission Act.

The OWRC-projects section made its own appraisals of submissions and co-ordinated those of the other divisions concerned with the processing of OWRC and provincially-financed projects. Liaison was maintained with the Ontario Department of Highways concerning its plans for highway construction in order to avoid conflict with pending OWRC and Provincial water and sewage projects and to plan, through the District Engineers Branch, for the removal of sanitary wastes from highway storm sewers.

The municipal-projects section, in addition to processing submissions, also made recommendations to the Ontario Department of Municipal Affairs on sewage and water works requirements for subdivision draft plans and official plans prepared under Section 26 and Section 12 of The Planning Act. In June, this latter responsibility was transferred to the District Engineers Branch.

Requests for information from the public and other government agencies, as well as special assignments from the Commission, were handled by the Branch.



Fig. 1
Summary of Water Works Approvals

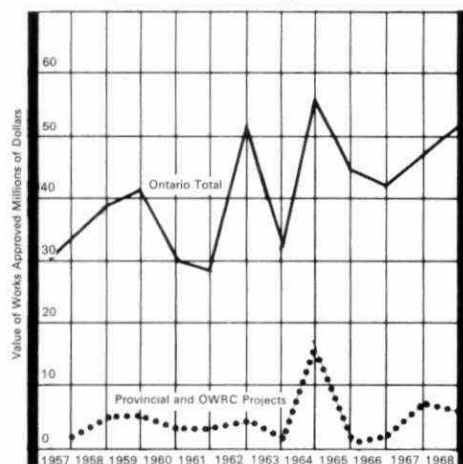
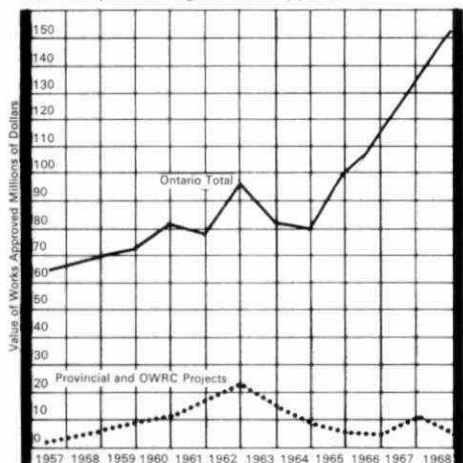


Fig. 2
Summary of Sewage Works Approvals



Special Assignments

The Branch repeated its fluoridation survey of all municipalities using controlled fluoridation.

A paper on "Statistical Analysis of the Effluent Quality of Biological Sewage Treatment Processes" was prepared and delivered to the Third Canadian Symposium on Water Pollution Research held at the University of Toronto, February 1-2, 1968.

A status report on "The Design, Cost, and Performance of Aerated Lagoons in Ontario" was presented at the 35th Annual Conference, the Canadian Institute on Pollution Control, held in Hamilton, October 20-23, 1968.

A special brief was prepared for the Commission on the County of Lambton Western Region Water Supply Scheme based on engineering reports prepared for the OWRC and the City of Sarnia.

Certificates of Approval

During the year the Branch processed 2,589 applications, subdivision reviews and engineering reports. These resulted in a total of 1,991 certificates of approval being issued at a total estimated cost of \$202,661,960.44. In 1967, 1,955 certificates were issued for water works, sewage works and industrial waste facilities at a total estimated expenditure of \$174,430,062.92.

Certificates issued for water works applications totalled 831 and involved an estimated expenditure of \$52,488,024.10, compared with 796 certificates and an expenditure of \$45,519,615.76 for 1967.

In the waste-water field 1,160 certificates were issued during the year at an estimated cost of \$150,173,936.34, as compared with 1,159 approvals in 1967 at an estimated cost of \$128,910,447.13.

Of the total certificates issued in 1968, 23 were for OWRC water works projects, and 36 were for

OWRC sewage works projects. Estimated costs of the projects were \$6,013,720.56 for sewage works and \$2,835,676.00 for water works.

Table 1
Summary of Water and Sewage
Works Approvals

Water Works	Estimated Cost
Extension to existing systems	\$ 45,182,214.36
Supply and purification	5,193,055.91
New systems	2,111,753.83
Total	\$ 52,488,024.10
Sewage Works	
Extensions to existing systems	\$109,886,293.79
Treatment and disposal	39,374,707.48
New systems	909,135.07
Farm animal wastes	3,800.00
Total	\$150,173,936.34

Certificates for works to be constructed under provincial financing issued in 1968 were as follows:

Table 2
Provincial Projects

Municipality	Water Works	Sewage Works	Total Estimated Expenditure
Amherstburg, Anderson and Malden	\$230,000.00	\$	\$ 230,000.00
Ear Falls Township	280,900.00	281,600.00	562,500.00
Beaverton		2,350.00	2,350.00
Grand Bend	295,552.00		295,552.00
Ignace Township		92,000.00	92,000.00
Moosonee Township	140,985.00	42,320.00	183,305.00
Pickering		12,200.00	12,200.00
Red Lake Township		2,150.00	2,150.00
Wallaceburg		1,510,000.00	1,510,000.00
Totals	\$947,437.00	\$1,942,620.00	\$2,890,057.00

The graphs on the previous page indicate the value of water and sewage works approvals from 1957 to the present. In 1968, for the first time in the history of the OWRC, the total value of water and sewage works approvals exceeded \$200 million.

Summary of Sewage Works Approvals

The progress made by OWRC in 1968 in the control of pollution from municipal sources is demonstrated in Table 3 which lists the approval of 8 new sewage treatment plants and 9 extensions to existing pollution control facilities.

Table 3
Municipal Water Pollution Control
Plant Approvals Issued During 1968

Municipality	New Plant or Extension	Estimated Cost
Acton	Extension	\$ 487,000.00
Burlington	Extension	765,000.00
Collingwood	Extension	834,680.00
Cumberland Township	New Plant	430,000.00
Crystal Beach	New Plant	361,000.00
Dunnville	New Plant	817,000.00
*Ear Falls	New Plant	120,000.00
Ernestown Township	Extension	60,000.00
Hagersville	Extension	35,000.00
Kenora	New Plant	1,179,500.00
Hamilton	Extension	15,300,000.00
Oakville	Extension	2,000,000.00
Port Elgin	New Plant	240,000.00
Toronto Metro	Extension	9,093,930.00
	(Ashbridges Bay)	
	(Humber Plant)	3,854,955.00
Walkerton	New Plant	792,700.00
*Wallaceburg	New Plant	1,510,000.00
		\$37,863,265.00

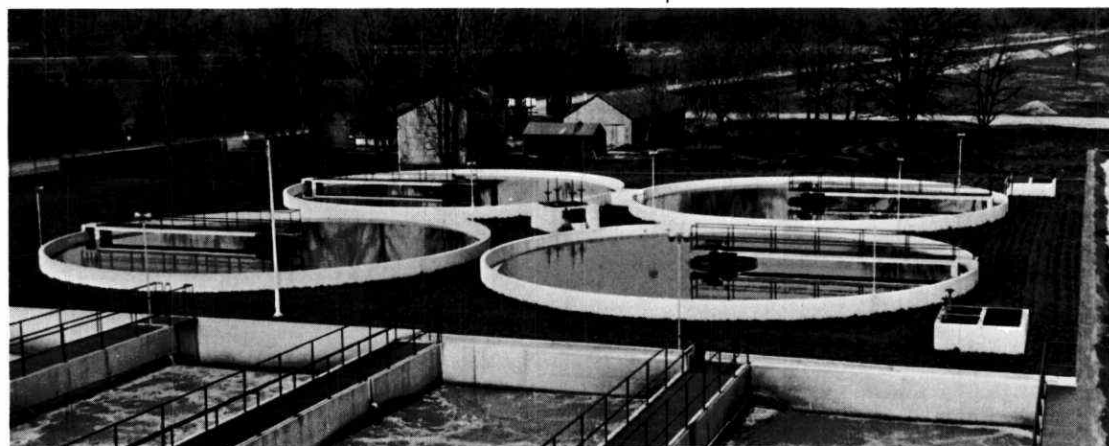
*Included in total costs for Provincial Projects in Table 2.

DISTRICT ENGINEERS BRANCH

Field work of this Branch, responsible for both service and regulatory programs, is carried out under the supervision of five district engineers, each of whom covers designated areas in Ontario. During the year, inspections and evaluations were made in every part of the Province.

With a view to providing an optimum level of service to the people of the Province, technical staff are now located in Toronto, London, Kingston and at the Lakehead. The latter office established late in the year, serves the districts of Rainy River, Thunder Bay and Kenora.

The routine work involved the assessment of water works and sewage treatment plants throughout the Province, the performance of water pollution surveys, the inspection of cattle feed lots, piggeries and chicken-raising plants relative to the possibility of their contributing to water pollution, and the evaluation of proposed plans of subdivisions and official plans with a view to providing recommendations regarding water supply and sewage disposal.



Water Works

There were 2,047 routine and special inspections made of water works by district staff as compared with a total of 2,112 in 1967. A total of 3,380 bacterial and 2,643 chemical samples were taken. The number of recorded water works inspection points increased from 1,023 in 1967 to 1,035 in 1968. The yearly inspection objective for the program was three visits for the following water works: chlorinated municipal, year-round private and industrial (including mines) with townsites; for systems not requiring disinfection, as well as summer-private and industrial (including mines) not having townsites, the objective was one visit. During 1968, 1,864 inspections were made of the routine inspection points. In 1967, there were 1,890 inspections made.

Waste-Water Treatment Works

There were 1,557 routine and special inspections made during 1968 of wastewater treatment works serving, generally, municipalities and industry. This compares with 1,567 inspections made in 1967. A total of 848 bacterial and 2,313 chemical samples was obtained while making these inspections.

The inspection objective for wastewater treatment facilities was three visits a year for secondary-type municipal sewage treatment plants, one inspection for septic tank facilities, with two inspections per year for waste treatment installations serving confined-feeding agricultural installations and primary-type municipal sewage treatment plants.

There were 1,230 routine inspections of sewage treatment plants and septic tanks systems as compared with 1,065 in 1967. The number of inspection points has steadily increased from 328 in 1962 to 494 in 1968.

Wastewater treatment facilities serving agricultural installations and sanitary landfill operations

were inspected by the staff of the Branch. During the year, 141 such inspections were made.

Municipal Water Pollution and Water Quality Surveys

As part of the pollution control program, field staff performed 86 municipal water pollution surveys. These surveys are designed to locate pollution points and promote the collection and treatment of the offending wastewater discharges.

During 1968, there were 46 water quality surveys performed. This type of survey is intended to evaluate the effect of wastewater discharges on the quality of surface waters. During these surveys, 1,914 bacteriological and 1,724 chemical samples were collected.

Subdivision and Official Plans

To ensure proper water supply and sewage disposal, the staff of the Branch provides to the Department of Municipal Affairs, an assessment of all subdivisions and official plans proposed for development in the Province. As indicated earlier in this report, this is a new program for the District Engineers Branch, these duties having been performed during the first half of the year by the Design Approvals Branch. There were 369 subdivisions and 45 official plans processed by the Design Approvals Branch and 408 and 56, respectively, by the District Engineers Branch during the year.

Miscellaneous

Meetings with Municipal Officials

The staff of the District Engineers Branch continued to have an increasing amount of direct contact with water works and sewage works officials and personnel throughout the Province. During 1968, there were 14 meetings with public utilities com-

missions and 86 with municipal councils. In addition, discussions were held with various municipal officials. In this connection, there were 576 discussions with municipal clerks, 702 with various other municipal officials, 300 with public utilities commission staff, 547 with health officials and 977 with other groups or individuals. This is an important aspect of the activities of the Branch as it brings about a direct contact between local officials and the Ontario Water Resources Commission in promoting the installation of necessary water and sewage works facilities.

Special Investigations

Special investigations requested by municipalities, the public or senior staff of the Ontario Water Resources Commission constitute a sizeable portion of the work of the Division of Sanitary Engineering. A total of 1,012 of these requests was received and acted upon.

Assistance to Other Branches and Divisions

The Division of Project Development draws heavily on the information and assessments of the Branch with respect to proposed projects.

Lectures are presented by staff OWRC-sponsored water works and sewage works operators instruction courses.

WATER QUALITY SURVEYS BRANCH

The planning and development of water quality management programs, together with the maintenance of necessary field surveys, are the responsibility of the Water Quality Surveys Branch.

Water quality control is maintained by monitoring the waters of the Great Lakes, their connecting channels and the inland drainage basins of Ontario

in locations where active and potential use may affect water quality. Manual and automated data collection techniques are used, along with aerial surveillance, to detect unusual waste spills and initiate any necessary corrective action. Engineering studies of water use, waste loadings and their effect on water quality are carried out on streams and in the harbours and coastal waters of the Great Lakes. The findings are used to develop guidelines for municipalities and industries in implementing the Commission's policy for water use in Ontario. This policy, as announced in 1967, permits the specification of waste loading limits for wastewater sources discharging to the water environment. It also provides for the development of plans for water use in the various drainage basins of the Province where required.

In the Great Lakes program, the surveys permitted the continuing definition of water quality trends in areas of intensive and potential water use in the coastal waters of the lakes, with increased attention being given to work on individual waste sources. As part of this work, techniques were developed for the processing and interpretation of data. This included statistical techniques for the optimum use of data obtained from sampling points, simulation modelling for thermal and waste discharges to the lake and the development of continuous current measurement and computer programs for the editing and analysis of this data. In addition, a report completing the two-year study of pollution in the lower Great Lakes was prepared for submission to the International Joint Commission (IJC). Details of this report are given below.

Planning studies on the Grand and Ottawa river basins continued. The latter project was undertaken in 1967 in co-operation with the Quebec Water Board and will continue into 1969. The work entails surveys of water used for all purposes and includes the establishment of guidelines for future



use of the river to control pollution.

In keeping with the policy guidelines for water quality control, there was an increase in the number of evaluations made of existing and proposed municipal and industrial wastewater discharges.

Great Lakes Program

The Great Lakes program continued within the framework established in 1965. It included water use studies and population forecasts, studies of the sources, character and disposition of waste introduced into the coastal waters of the lakes and their connecting channels, water quality problems including nutrient additions, oxygen depletion, build-up of conservative chemicals, bacterial and biological pollution and development of needed remedial measures.

The results of the OWRC investigations pertaining to the international pollution problems were incorporated, with similar information from other Canadian and U.S. agencies, into a joint report being prepared through the IJC. This report, consisting of three volumes, is to be submitted in 1969 to the IJC by its Technical Advisory Boards with representatives from the two countries. Volume I summarizes the pertinent data contained in Volumes II and III and states the conclusions and recommendations. Volume II (Lake Erie) and Volume III (Lake Ontario—St. Lawrence River) contain a compilation of data and other information which has been developed to assess pollution, identify the sources of pollution, and develop the necessary remedial measures and their estimated costs.

Vessels employed during the 1968 season were the M. V. Atomic, M. V. Lac Vancouver, M. V. Cato II, M. V. Monitor and M. V. Pelican.

Field work on Lake Ontario extended from May 6th to October 24th and included six monitor surveys in the coastal waters from the Niagara River to the Bay of Quinte. The detailed studies of Toronto and Hamilton harbours continued with a view to obtaining sufficient background information for a comprehensive program of water use planning and management along the waterfront areas. Work was also carried out in the harbour at Trenton and in the vicinity of the Toronto Harbour infill project.

A specially-equipped helicopter was utilized on a trial basis to sample Lake Ontario from Oshawa to Toronto. For the first time, the Commission carried out survey work during the winter season on Lake Ontario utilizing the catamaran Cato II. The winter program included a monitor survey from Port Dalhousie to Toronto, a Toronto Harbour study, and a survey of the lower Niagara River. In Lake Erie, survey work extended over the period from June 10 to September 9. This included five monitor surveys of the western and eastern basins and the waters along the north shore. Detailed harbour studies at Port Rowan, Wheatley and Leamington and water quality evaluations at Crystal and Nickel beaches were also carried out.

The surveillance programs and detailed waste source investigations were continued in the inter-connecting channels during the period April 16 to October 10. Five surveys were completed on the St. Clair and Niagara rivers and six on the Detroit River. An additional survey was also carried out at the confluence of the Niagara River and Lake Ontario. Two surveys, including a waste outfall investigation, were made on the St. Marys River. The International Section of the St. Lawrence River was also sampled twice during August and October. Water quality conditions in Lake Huron and Georgian

Bay were examined twice during the period July 16 to August 24. A study of water quality conditions was also carried out in Lake Superior. A water quality and waste outfall investigation was completed in Thunder Bay at Port Arthur.

Trace organic constituents within the Great Lakes system were monitored at Dunnville, Kingston, Kingsville, New Toronto and Port Lambton, employing carbon adsorption units.

Noteworthy were the current and water quality studies carried out in the coastal waters of Lake Erie and Lake Ontario at the sites of the Nanticoke and Pickering thermal generating stations. The studies will provide baseline data on the movement and quality of water in these areas before the power plants commence operation. A thermal study was undertaken at the mouth of Duffin Creek to determine the effects of a warm effluent on water quality in Lake Ontario and a similar study was carried out at the Lakeview generating station.

Sixteen oil spills were investigated in the surveillance work on the St. Marys, St. Clair, Detroit and St. Lawrence rivers, and on Lake Erie and Lake Ontario, compared to seven in 1967. Where the source of the problem was identified, action was taken to prevent a recurrence. Included in this surveillance work were the investigations of oil discharges from an industry to the St. Marys River and from a commercial vessel to the St. Clair River. In the latter incident, the vessel owner was convicted and fined \$1,500.00

River Basin Surveys

The river basin planning studies, which commenced in 1967 on the Grand and Ottawa rivers, continued. These projects are designed to examine the major

factors affecting water quality and use in the basins. In the Grand River basin, field studies were made downstream from Brantford, Guelph and Waterloo. Reports on these studies were in preparation for inclusion in a comprehensive report on the basin.

Water quality monitoring in the Ottawa River basin was expanded to provide monthly data on the main river from Timiskaming downstream to Oka—a distance of 325 miles. A continuous 72-hour study was also carried out on the lower Ottawa River between Ottawa and Oka in co-operation with the Quebec Water Board. Two helicopters and four boats were required to undertake this project covering a 90-mile section of the river. Fifty per cent of the field work in the Ottawa basin was completed, with the balance scheduled for completion in 1969.

In addition, studies were carried out on the Avon River below Stratford, Uxbridge Brook at Uxbridge, the Credit River below Orangeville, and downstream from the pulp and paper mill at Dryden on the Wabigoon River. The latter was an extensive project requiring a helicopter to carry out the work in the 60-mile section of the river downstream from Dryden.

The investigation on the Abitibi River below the pulp and paper mill at Iroquois Falls was completed and a drainage basin report prepared for publication.

The field work for the nutrient loading studies on Duffin and Catfish creeks which commenced in 1967 was completed. These basins, which represent areas of mixed rural and urban use, were selected to determine the nitrogen and phosphorus contributions from various sources including wastewater discharges and land drainage.

Water Quality Monitoring

The water quality monitoring program designed to provide monthly, seasonal and annual variations in water quality at selected stations in Ontario was intensified. Samples were collected from 290 streams at 563 locations, compared to 375 locations in 1967. The program was expanded in Northern Ontario to include 79 stations on the main rivers. Thirteen conservation authorities, one health unit and the Ontario Department of Lands and Forests assisted in the collection of samples.

The Commission's first robot monitoring station, acquired in 1967, continues to operate on the St. Clair River downstream from the Sarnia industrial complex. Dissolved oxygen, temperature, conductivity, pH and chlorides are continuously measured and recorded by these units. Two additional robot monitoring stations were acquired during 1968, with one installed on the Ottawa River about 90 miles downstream from Ottawa and the second planned for installation upstream from Mattawa.

Investigations to determine the changes in the quality of water resulting from uranium mining activities in the Elliot Lake and Bancroft areas continued. The collection of baseline data in the Agnew Lake area and sampling of the harbour at Port Hope were also carried out.

Waste Treatment Evaluations

Twenty-one evaluations were made of existing and proposed municipal and industrial wastewater discharges. Waste loading limits for wastewater sources were specified in relation to the effects of these discharges on the present and forecasted uses of the receiving waters.



PLUMBING AND BOATING BRANCH

Plumbing

In the Province of Ontario the installation, maintenance and repair of plumbing, with a few minor exceptions, is controlled by the Provincial Plumbing Regulation. It is the responsibility of this Branch to maintain an up-to-date regulation and provide technical liaison with municipal inspectors. The Branch is assisted in its function of maintaining a modern code by the Plumbing Advisory Committee made up of representatives from industry, municipal regulatory authorities and design consulting engineering firms.

The current trend to prefabricated housing is creating an inspection problem. The plumbing for this type of housing is constructed and installed in one municipality and placed into service in another. This is increasing the pressures already existing in some areas to have plumbing inspection done by the Province rather than by the municipality.

Watercraft Pollution Control

An Advisory Committee was established early in 1968 to assist with the implementation of the pleasure boat Regulation scheduled to go into effect June 1, 1968. To support the main committee, a Shore Facilities Sub-Committee and a Boat Equipment Sub-Committee were also formed.

The Advisory Committee recommended that the Regulation be delayed to January 1, 1969, to allow further time for the standardization of equipment and the provision of pump-out facilities. The delay also permitted a joint meeting to be held in Toronto to see if compatibility of legislation, equipment standards, and implementation policies could be achieved with the bordering provinces and states.

Good progress has been made in all these areas. With respect to compatibility, it was concluded at the international conference that some natural uniformity already existed. The meeting also brought to light certain areas where improvements could be made. The Boat Equipment Sub-Committee completed a Performance and Dimensional Guide-line outlining specifications for boat sewage retention devices and systems. Approximately 50 Ontario marina and yacht club operators have confirmed that they will be offering pump-out service during the 1969 boating season.

Commission staff are continuing to meet with various boating organizations and are visiting marinas to offer additional assistance in connection with proper disposal of sewage in and from pleasure boats.

REGIONAL SERVICES PLANNING BRANCH

In accordance with government policy, studies and reports were undertaken during the year on the provision of water supply and pollution control facilities on a regional basis in developing areas throughout the Province. The assistance of other divisions and branches of the OWRC and other government agencies and departments was obtained in order to clearly define the problems and to produce the most reasonable scheme(s) based on engineering, economic and other general considerations.

Assistance was provided to other divisions in reviewing proposals in regions where Branch studies had previously been completed or were in progress. Specific information was provided in several instances to management utilizing recent field and office data. Two oral presentations of studies done by consultants were made to elected

and appointed officials. Three council meetings and one planning board meeting were attended to discuss the findings of the studies.

Following numerous meetings and discussions, the Commission report on the Middle Grand River Region—Water Supply Study, completed in late 1966, was edited, reprinted and distributed to provincial and municipal officials.

The Southern Ontario County and Region—Water Supply and Pollution Control Study was completed and presented to the Commission. Due to the fact that the Metropolitan Toronto and Region Transportation Study presentation was shortly to be made, the findings were held temporarily in abeyance. Subsequently, direction was received to distribute a summary of the report to the interested bodies. Proposals for development in the study area were reviewed and discussed with other government departments. A staff member was appointed to represent the Commission on the Oshawa Area Planning and Development Study.

The Lakehead Area—Regional Water Supply and Pollution Control Study was essentially completed. Printing, presentation to the Commission and possibly public distribution should take place early in 1969.

Work commenced on the Province of Ontario—South-Western Area-Water Supply Study comprising data collection, summation and evaluation. The study is to be completed during 1969.

Data from other divisions and branches relative to the Grand River Watershed—Pollution Control Study were received for the report to be undertaken in 1969.

A representative of the Branch participated in the Metropolitan Toronto and Region Transportation Study and prepared comments which were forwarded

to the Department of Treasury and Economics after the presentation of the report findings to the public by the Prime Minister.

A representative of the Branch was appointed to the Area Planning and Development Coordinating Committee and was requested to chair the Public Works Technical Advisory Committee of the Waterloo-South Wellington Area Study. A prospectus for the latter committee has been prepared and should be approved, printed and publically distributed early in 1969.

Comments on the Waterfront Plan for the Metropolitan Toronto Planning Area were solicited from all divisions, summarized and forwarded to the Planning Board.

A brief on the location of water treatment facilities associated with provincially-financed pipeline projects was reviewed, revised and printed for the Commission.

Numerous meetings involving proposals to utilize further the Province's water resources were attended. The activities of the OWRC and this Branch were outlined to members of the State of California Water Resources Control Board and a planner from Brazil. Comments were prepared on a proposal to create inland waterways in Lambton County by water diversion.

The long-range program for future studies has been reviewed and revised to produce a schedule aligned to the proposals for the creation of regional government units in certain areas of the Province.

Division of Water Resources

K. E. Symons, Director

D. N. Jeffs, Assistant Director

The Division of Water Resources is responsible for the quantitative assessment and management of the Province's water resources. The work is carried forward through four branches with established programs concerned with water resources surveys, test-drilling and well-construction projects, water management, well construction management, collection and analysis of basic hydrometric data and scientific hydrologic studies.

The work of the Division is reported under broad divisional and specific branch activities.

Cartography

The Cartographic Section supported all of the programs of the Division by preparing maps, charts, and diagrams and by procuring maps, plans, aerial photographs and mosaics from various sources. For the Big Otter Creek Survey, 6 large multicolour maps were completed and printed and 7 multicolour figures and 19 monochrome figures were completed for printing. Fifteen large monochrome maps were completed for use in other programs along with 16 formal figures and illustrations.

ARDA Projects

Water resources surveys in the drainage basins of Big Creek and Big Otter Creek were initiated in 1964 and 1965, respectively, and qualified for support under the Agricultural Rehabilitation and Development Act. This work is an activity of the Surveys and Projects Branch which made progress on the reports for both surveys.

International Hydrological Decade Program

Several studies of the Division had been accepted as projects under the International Hydrological Decade



program, a world-wide program designed to advance the science of hydrology and the assessment and understanding of regional and global water resources.

The River Basin Research Branch continued to study the hydrologic characteristics of five representative river basins in Southern Ontario and started to assess the ground-water contribution to Lake Ontario as part of a multi-disciplinary study of water balance under the International Field Year on the Great Lakes, 1971/72.

The Hydrologic Data Branch worked on two projects: assessment of ground water and assessment of surface water. Some special work was undertaken under the former while both were planned to progress through the Branch's regular data collection and analysis programs.

The Division participated in the work of the Ontario Committee for the International Hydrological Decade and its scientific and educational subcommittees and had representation on the Working Group on the Terrestrial Water Balance and associated sub groups set up to plan and coordinate the work for the International Field Year on the Great Lakes.

Northern Ontario Water Resources Studies

The Division continued the studies of the water resources of northern Ontario. The Surveys and Projects Branch extended studies designed to determine hydrologic characteristics of drainage basins from the upper basin of Albany River into the lower basin. The Hydrologic Data Branch made general hydrometric investigations throughout the region and concentrated on the expansion of the surface-water and ground-water hydrometric networks. Close liaison was maintained with two federal

agencies, the Water Survey of Canada (Inland Waters Branch, Department of Energy, Mines and Resources) and the Meteorological Branch (Department of Transport).

The Division participated in the work of a Federal-Provincial Co-ordinating Committee on Northern Ontario Water Resources Studies. Through this committee and an "ad hoc" Working Group comprised of representatives of federal and provincial agencies contributing to the studies, close co-operation was maintained.

Data Processing Activities

A close liaison was maintained with the Systems and EDP Branch of the Commission in the design and development of the Water-Well Record System and its associated activities. The STORET System of watershed codes was initiated in the Division with the coding of rivers and streams in the Lake Erie basin for use in the Division's Water-Taking Permit System. In support of Projects carried out by the River Basin Research Branch, the QUIKTRAN terminal of the Systems and EDP Branch was used to carry out statistical analyses.

The international symposium on "Analogue and Digital Computers in Hydrology", sponsored by the International Association of Scientific Hydrology, was attended.

SURVEYS AND PROJECTS BRANCH

The Surveys and Projects Branch was active in water resources inventory surveys, water-supply development surveys and projects, and special investigations. The water resources inventory surveys included drainage basin surveys in Northern and Southern Ontario. Water Supply development surveys

included regional studies and municipal hydrogeologic surveys. Water-supply projects consisted of test-drilling and well-construction programs for municipal purposes. Special investigations involved studies of specific water-supply problems and ground-water pollution.

Work progressed on two drainage basin surveys in Southern Ontario and was initiated on a third. In Northern Ontario, work started in the previous year was extended into the lower portion of the basin. One regional study was completed and field work initiated on two others. Twenty-five ground water surveys, twenty-five test drilling or well-construction projects, and fifty-one special investigations were completed or in progress. Tables 1 and 2 and Figure 1 present a summary of these activities.

Drainage Basin Surveys

In Southern Ontario work was continued on the preparation of reports on water resources surveys carried out in previous years on the Big Creek and Big Otter Creek basins. Some progress was made on the report on the Big Creek Survey and the report on the Big Otter Creek Survey was completed in draft form and was under final editing. A basin survey was started in the upper portion of the Nottawasaga River. The field work and some of the text for the report were completed.

In Northern Ontario the basin survey, initiated in 1967 in the Albany River, was extended into the lower reaches. A draft report was prepared on the work in the upper portion and a report was in progress on the work in the lower portion.

Regional Studies

An evaluation of the availability of surface water resources in the Grand River Watershed was

completed. The evaluation was made in support of a Commission report on inter-divisional studies of regional water supply requirements. Planning and field work were initiated on similar studies for the northern area of the counties of Ontario and York, and for the counties of Lincoln and Welland.

Municipal Hydrogeologic Surveys

Surveys, commenced in 1967, to evaluate ground-water conditions for municipal water-supply purposes were continued for 6 municipalities and initiated for 19. Fifteen reports were released. At the end of the year, surveys were in progress for the City of Guelph, the Town of Webbwood, the villages of Hastings, Maxville and Omemee, the communities of St. Charles, Summerstown and Verner, the Centralia area and the Township of Nepean. Surveys were completed for the City of Woodstock, the Township of Markham, the villages of Casselman, Killaloe Station, Lancaster, L'Orignal, Stouffville, Sundridge, and Westport, and the communities of Baden, Fauquier, Hornepayne, Manitowaning, Mount Albert and Nakina. Table 1 shows that 18 of the surveys are for proposed provincially-owned systems.

Test Drilling and Well Construction Projects

Test-drilling projects to locate municipal ground-water supplies were carried forward for 9 municipalities and initiated for 10. Well-construction projects to develop municipal water supply wells were carried forward for 2 municipalities and initiated for 4. In all, the Branch dealt with 25 test-drilling and well-construction projects. Test-drilling projects located suitable ground-water supplies at Barry's Bay, Blezard Valley, Callander,



Drayton, Millbrook, Plattsville and Rockwood and were in progress or in pre-contract stages at Baden, Killaloe Station, Lancaster, L'Orignal, Thornbury, Vermilion Bay and Woodville. Well-construction projects were completed at Minden, Oak Ridges, Plantagenet, Schomberg and Stayner. All test-drilling projects were for proposed provincially-owned systems; all well-construction projects were for OWRC-Municipal systems.

Special Investigations

Fifty-one special investigations or studies into ground-water pollution, water-supply problems and the effects of landfill disposal of sanitary and industrial wastes on ground water were completed or initiated. Eight investigations were carried forward from the previous year and seven were in progress at the end of the year. Seventeen of the investigations dealt with ground-water pollution, 21 with water-supply problems and 3 with the effects of waste disposal on ground water. Five investigations were made on behalf of the Ontario Department of Highways with regard to actual or potential ground-water pollution by road salt spreading or stockpiling.

Fig. 1
Active and Completed Surveys
Projects and Investigations

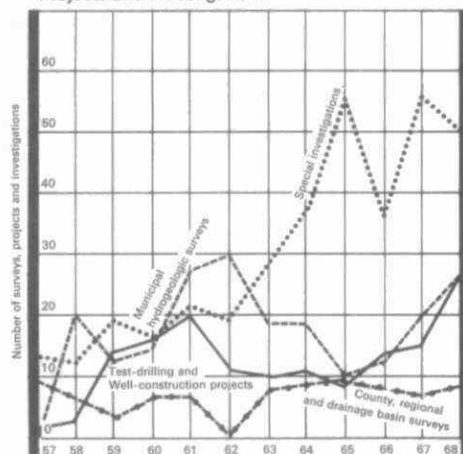


Table 1
Summary of Survey Activities—1968

Activity	Location	Field Work Completed	Report Completed
Drainage Basin Surveys	Big Creek	x	—
	Big Otter Creek	x	—
	Upper Nottawasaga River	x	—
	Upper Albany River	x	x
	Lower Albany River	x	—
Regional Studies	Grand River	x	x
	Counties of Ontario and York	—	—
	Counties of Lincoln and Welland	—	—
	Baden*	x	x
	Casselman*	x	x
Municipal Hydrogeologic Surveys	Centralia Area	x	—
	Fauquier*	x	x
	Guelph	x	—
	Hastings*	—	—
	Hornepayne	x	x
	Killaloe Station*	x	x
	Lancaster*	x	x
	L'Orignal*	x	x
	Manitowaning*	x	x
	Markham Township	x	x
	Maxville*	x	—
	Mount Albert*	x	x
	Nakina*	x	x
	Nepean Township	x	—
	Omeme*	x	—
	St. Charles*	x	—
	Stouffville	x	x
	Summerstown*	x	—
	Sundridge*	x	x
	Verner*	x	—
	Webbwood	x	—
	Westport*	x	x
	Woodstock*	x	x

*Proposed provincially-owned System

Table 2
Summary of Project Activities—1968

Activity	Location	Contract in Preparation	Field Work		Report Completed	Wells Completed	
			Active	Completed		Test	Production
Test Drilling	Alvinston				x	3	
	Baden	x					
	Barry's Bay			x		2	
	Bleazard Valley				x	19	
	Bruce Mines				x	3	
	Callander 1.				x	11	
	Callander 2.		x			10	2
	Drayton				x	1	1
	Haliburton				x	13	
	Killaloe Station	x					
	Lancaster	x					
	L'Orignal	x					
	Millbrook				x	2	
	Plattsville				x	4	1
	Rockwood				x	2	2
	Sundridge				x	4	
	Thornbury		x			5	
Well Construction	Vermilion Bay	x					
	Woodville	x					
	Minden				x		1
	Oak Ridges			x			1
	Orleans				x	19	2
	Plantagenet			x			1
	Schomberg			x		1	1
	Stayner				x		1

WATER AND WELL MANAGEMENT BRANCH

The activities of the Water and Well Management Branch were carried out under two programs: water management and well-construction management.

The main activities under the water management

program included processing applications and permits for the taking of water, investigating and reporting on complaints concerning alleged interference with water supplies and enforcing associated legislative and permit requirements. Under the well-construction management program, activities mainly concerned licencing water well contractors, checking locations of new wells and their sanitary construction, investigating complaints against water-well contractors and possible infractions of statutes and regulations, and developing revised and additional water well construction regulations. Figure 2 shows the surface-water and ground-water investigations carried out since 1961 and the well-construction investigations since 1965.

WATER MANAGEMENT PROGRAM

Applications and Permits

Table 3 shows a summary of water permit data for 1968. Of the 445 permits issued, 261 were for irrigation, 37 for municipal-supply purposes, 71 for industrial purposes, 5 for commercial purposes and 71 for recreational purposes. A total of 242 permits were cancelled, most because of a change in ownership of properties, and 194 amendments were authorized by the Commission.

Table 4 shows the number of permits issued and the amount of takings authorized for 1968, according to drainage basin, source and purpose. Table 5 is a summary of amounts of water taking approved by permit for various purposes since 1961. Figure 3 shows graphically the amounts and purposes of authorized surface-water and ground-water takings since 1961.

Fig. 2
Types of Investigations

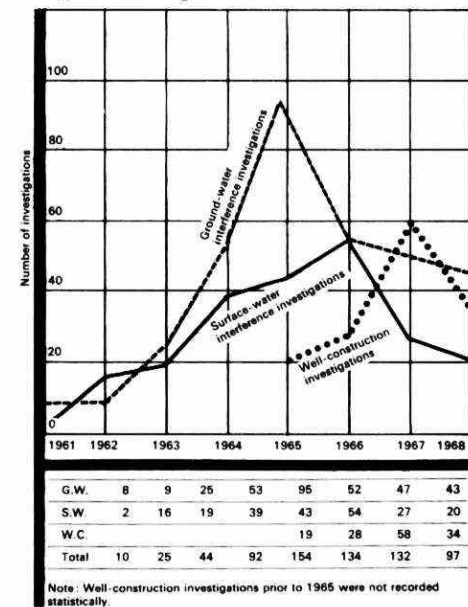


Fig. 3
Amount of Water Taking Authorized
by Permit According to Year and Source

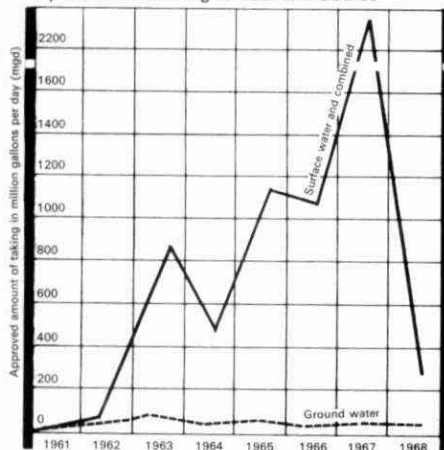


Table 3
Summary of Water Permit Data for 1968

SOURCE	Carried Forward From 1967	Received in 1968	Refused Withdrawn or not Required	APPLICATIONS		Under Consideration on December 31, 1968	Amount of Water Taking Approved by Permit* (MGD)
				APPROVED			
				By Letter	By Permit		
Ground Water	34	106	13	28	58	41	18.03
Surface Water	63	418	46	1	370	64	262.30
Ground and Surface Water	6	19	1	—	17	7	7.14
Total	103	543	60	29	445	112	287.47

*Does not include water takings approved by letter of approval or by permits where conditions of taking rather than amounts were specified.

Table 4
Permits Issued and Takings Authorized in 1968 According to Drainage Basin, Source & Purpose

DRAINAGE BASIN	SURFACE WATER					GROUND WATER					COMBINED TAKING					TOTALS
	Comm.	Ind.	Irr.	Mun.	Rec.	Comm.	Ind.	Irr.	Mun.	Rec.	Comm.	Ind.	Irr.	Mun.	Rec.	
St. Lawrence River			1 .05						3 .59							4 .64
Ottawa River		5 4.07	5 1.15		2 S.C.		2 .06	1 .15	6 .46							21 5.89
Lake Ontario		12 21.31	2 S.C. 36 5.73	1 150.12	27 S.C. 1 .02	1 .14	4 .52	2 .56	4 2.46			3 1.14	2 1.14			95 183.14
Lake Erie & Lake St. Clair		14 11.77	177 50.85	1 1.08	11 S.C.	1 .04	6 2.94	8 2.35	10 3.91				11 4.85			238 77.79
Lake Huron	3 .42	20 12.65	16 2.26	4 .07	30 S.C.		3 .68		7 3.17				1 .01			84 19.26
Lake Superior		1 .42														1 .42
Hudson Bay		1 .03		1 .30												2 .33
Totals	3 .42	53 50.25	2 S.C. 234 60.04	7 151.57	70 S.C. 1 .02	2 .18	15 4.20	11 3.06	30 10.59			3 1.14	14 6.00			445 287.47
GRAND TOTALS			370 262.30					58 18.03					17 7.14			

NOTES: (i) In each square the number of permits issued appears above with the amount of authorized water takings in MGD.

(ii) S.C.—Permits are issued under special conditions; no rates or amounts of water takings are specified.

(iii) Purposes—COMM.—Commercial; IND.—Industrial; IRR.—Irrigation; MUN.—Municipal; REC.—Recreational

Table 5
Summary of Amounts of Taking Approved by Permit for Various Purposes

PURPOSE	1961 MGD	1962 MGD	1963 MGD	1964 MGD	1965 MGD	1966 MGD	1967 MGD	1968 MGD
Commercial	0.28	3.88	0.36	1.48	0.36	1.45	.48	.61
Industrial	10.34	10.45	26.38	329.14	947.91	1310.08	2238.94	55.58
Irrigation	0.38	8.88	774.09	51.49	134.82	94.23	96.46	69.11
Municipal	6.53	12.13	21.24	103.62	31.49	17.69	18.16	162.15
Recreation	—	—	0.93	0.23	0.05	0.07	4.31	.02
TOTALS	17.53	35.34	823.00	485.96	1115.63	1423.52	2358.35	287.47

NOTE: The amounts do not include water takings approved by letters of approval or by permits where conditions of taking rather than amounts were specified.

Renewal Applications and Permits

Nine-hundred and forty-two renewal applications for Permit To Take Water originally issued in 1963 were received during the year. By December 31, 1968, 851 permits had been renewed, 19 applications had been withdrawn, 56 applications were under active consideration and 16 applications were awaiting additional information.

Water Management Investigations

Sixty-three ground-water and surface-water interference problems were investigated during the year. The numbers of both ground-water and surface-water investigations were lower in 1968 than in 1967, probably due to generally wet spring and summer conditions.

Ground-Water Interference Investigations

Forty-three investigations of ground-water interference problems were carried out and reports were completed for 25 of the problems during the year. Some of the investigations required repeated field trips to assemble sufficient data to resolve causes and responsibilities clearly.

The municipalities in which investigations were carried out are indicated below. The figures in brackets indicate the number of separate complaints when more than one was investigated.

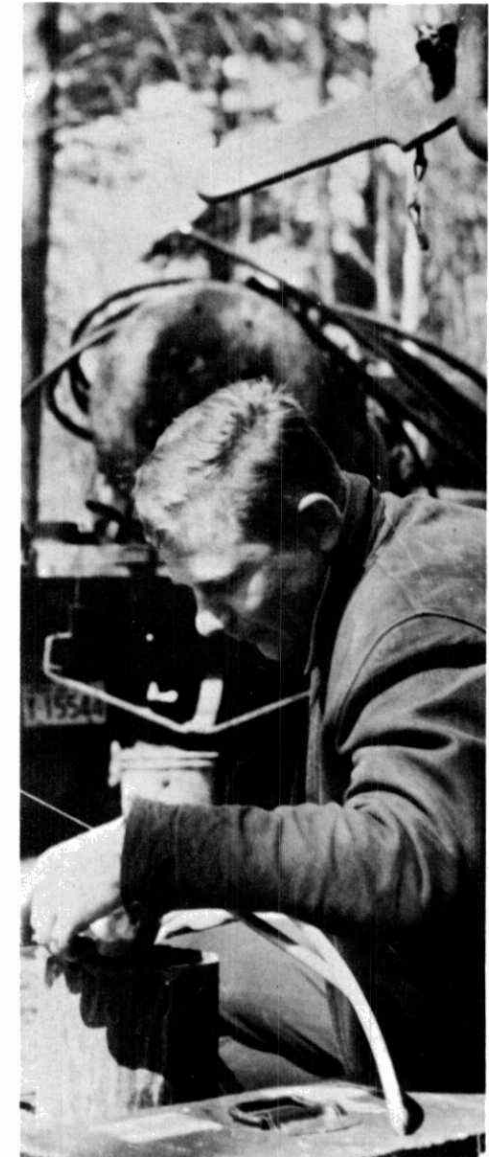
Townships: Ashfield, Caledon, Chinguacousy (4), Colchester South, Darlington, Delaware, Downie, Dunn, Esquesing (2), Glanford, Humberstone, Huron, King, Front of Leeds and Lansdowne, March and Goulbourn, Markham (3), Mississauga, North Dorchester, North York, Orillia, Otonabee, Pickering, Sarnia, Smith, South Dumfries, Vaughan (2), West Flamborough, West Oxford, Waterloo, Whitechurch and Woodhouse.

Towns: Bradford, Kapuskasing, Leamington, Pembroke, St. Mary's and Stayner.

City: Sault Ste. Marie.

Complex well interference studies requiring numerous field investigations were undertaken in the townships of March and Goulbourn and Sarnia and in the City of Sault Ste. Marie.

Townships of March and Goulbourn—A number of private well supplies were deemed to be significantly affected by the operation of the Glen Cairn well by the Township of Goulbourn. On notification that two additional municipal wells were being constructed in the Kanata subdivision, a long-term ground-water assessment study was started in the area of the Glen Cairn and Kanata subdivisions to provide background data for resolving further interference and development problems related to the Nepean sandstone aquifer. Three automatic water-level recorders were installed on observation wells as part of this assessment study and investigations



were continued into complaints by persons whose wells had not been made accessible during previous investigations. Information was collected from private wells and the Glen Cairn municipal well during test pumping of a newly-constructed well for the Kanata subdivision. This information will be used in assessing a number of existing complaints of well interference.

Township of Sarnia—Considerable time was spent in collecting ground-water data in the vicinity of some sand pits being de-watered in the Township of Sarnia. The pumping of water from the pits lowered water levels in nearby wells and a pond. Steps were taken to raise ground-water levels in the area by recharging a pond. Arrangements were made to supply water to the complainants' properties in a manner acceptable to the Commission; however, these arrangements were not accepted by the complainants.

City of Sault Ste. Marie—Several investigations were undertaken into complaints of well interference arising from the operation of the Goulais Avenue municipal wells. The well supplies of only two persons, of 100 persons interviewed, were found to experience significant, serious interference after 20 days of pumping.

Surface-Water Interference Investigations

Twenty investigations of complaints concerning interference with surface-water supplies or depletion of streamflow were made and reports were completed for nineteen of the investigations.

The municipalities where investigations were carried out are indicated below. The figures in brackets indicate the number of investigations in municipalities where more than one problem occurred.

Townships: Collingwood, Darlington, East Flamborough, Erin, Haldimand (2), Hamilton, Hope, King, Malahide, Markham, Mono, Mulmur, Reach, Uxbridge, Vaughan, Whitby and Whitchurch.

Towns: Burlington and Preston.

Water Taking Investigations

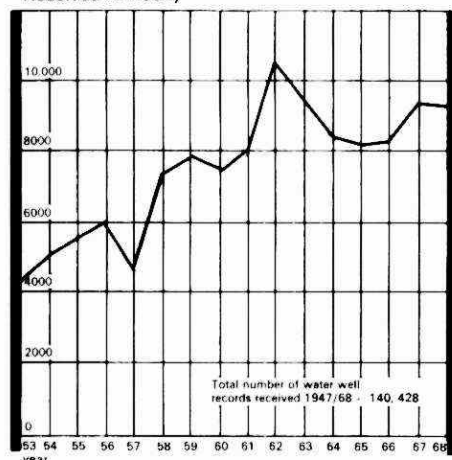
During the year, 630 farms were visited by members of the staff. The water-taking practices of 64 permit holders were checked and 257 applications for permits were obtained. In addition, 240 farm owners were visited specifically to obtain data required to process applications and to check on locations and sources. Irrigation was not practised on 36 of the above-mentioned farms.

WELL CONSTRUCTION MANAGEMENT PROGRAM Well Contractors

Four hundred and fifty-three licences were issued in 1968 for carrying on the business of boring or drilling wells for water; 36 licences were for boring contractors and 417 licences were for drilling contractors. Records for 9,464 water wells were received during 1968. The number of records received annually for the years 1953 to 1968, inclusive, is shown in Figure 4. The four inspectors visited water-well contractors on 1,007 occasions and made 6,492 checks on the locations of wells and 1,879 checks for sanitary well construction.

Proposed changes to the water-well regulations made under The Ontario Water Resources Commission Act were finalized and submitted to the Commission for consideration. A study of areas where special construction methods might be required because of above-ground hydrostatic heads continued.

Fig. 4
Number of Water Well Records
Received Annually



A conference for water-well contractors was held at the OWRC Laboratory with a total registration of ninety-nine. Members of the Branch staffed a display booth at the Canadian Water Well Contractors' Association Annual Convention and presented papers at the Technical session and in the Official Program.

Investigations Concerning Well Regulations

Thirty-four investigations concerning well regulations were carried out during the year and reports were completed for 32 of these.

The municipalities where investigations were carried out and the number of investigations in municipalities where more than one problem occurred are listed below:

Townships: Adjala, Albion (3), Amabel, Asphodel (2), Brantford, Blenheim, Brunel, Carling, Chinguacousy, Cumberland, Georgina, Haldimand, Hamilton, Hawkesbury, Hope, Kenyon, King (2), North Gwillimbury (2), Ops, Osgoode, Pickering, St. Edmunds, Sandwich South, Sombra, South Gosfield, Stisted, Tecumseth, Whitchurch and Wilmot.

HYDROLOGIC DATA BRANCH

The Hydrologic Data Branch continued the collection, analysis and distribution of hydrologic data. Basic networks for the measurement of streamflow and ground-water levels were expanded and maintained and hydrometric measurements made for a number of specific programs. The Branch served the public and internal programs by supplying information on streamflow, ground-water levels and aquifer conditions.

Observation Wells

An assessment of the existing observation-well network was made and 28 inactive stations for which no data were being received were removed from the records. Fifteen new observation wells were established. The number of active observation wells at the end of the year was 117. Figure 5 shows the number of observation wells in operation at the end of each year since 1957. All observers are volunteers and their valuable public service is gratefully acknowledged.

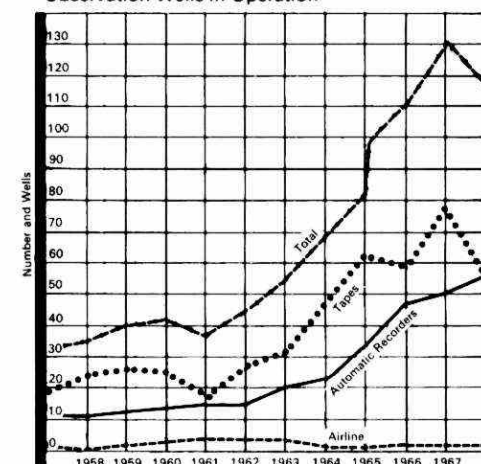
Hydrogeologic Data

Water-well records submitted by licensed water-well boring and drilling contractors were filed by the Branch for internal and public use. A total of 6,841 records were filed during the year. Ground Water Bulletin 6, which contained data abstracted from water-well records and observation well records for the Southwestern Area for the years 1960-1963, was published.

All water-well records to the end of 1967, together with a small number for 1968, were assigned permanent numbers for data processing purposes. The records numbered totalled 132,337. The work of plotting wells from the numbered records on topographical sheets was initiated for the purpose of determining co-ordinates and elevations. In addition, the data were being coded in a computer format. The records for the County of Lincoln were completely processed while records for many other areas in the Lake Ontario basin were in various stages of processing.

A map showing the probable ground-water yield for the County of Lambton was prepared. Minor review and adjustments are to be made before publication.

Fig. 5
Observation Wells in Operation



Public Enquiries

The demand for hydrogeological information continued throughout the year. As a result of public enquiries, 72 summaries of ground-water conditions were prepared, 126 letters were written and a total of 4,835 copies of water well records were distributed. Much time was spent in disseminating information on ground-water conditions through 631 telephone calls. One hundred and ten visits were made to the office by persons who consulted the records or discussed ground-water conditions with staff members.

Surface Water Data

Streamflow data were assembled by the Branch through the operation of 103 streamflow gauging stations of which 23 were fitted with automatic water-level recorders. Twelve of the recording installations were in the Hudson Bay drainage basin and were equipped with recorders only during the open water season; these stations were operated as manual stations at other times. The stations operated by the Branch support other programs. The number of stations for the various programs are as follows: 42 for the water quality monitoring program, 24 for the radiological pollution investigation program, 8 for the drainage basin survey program, 15 for the Northern Ontario Water Resources Studies, and 14 for special studies.

The Branch co-ordinates a program for the co-operative installation and operation of streamflow gauging stations with the Inland Waters Branch of the Canada Department of Energy, Mines and Resources. The number of stations under the co-operative program was 59; of these 33 were in the St. Lawrence drainage basin and 26 in the Hudson Bay drainage basin; 50 were recording stations and

9 were manual stations which included 5 lake-level gauges in the Hudson Bay drainage basin.

A summary of stations by operating agency is shown in Table 6. The Inland Waters Branch also operates and publishes data for a large number of other stations in the Province. Figure 6 shows the type and number of streamflow stations operating at the end of each year since 1963.

Table 6
Summary of Types of Streamflow
Gauging Stations by Operating Agency

	St. Lawrence Drainage Basin		Hudson Bay Drainage Basin		Total
	Recording	Manual	Recording	Manual	
Hydrologic Data Branch	11	77	12*	3	103
Inland Waters Branch—supported by the Division of Water Resources	29	4	21	5**	59
River Basin Research Branch	19	10	0	0	29

* recording during open water season only.

**lake level gauges.

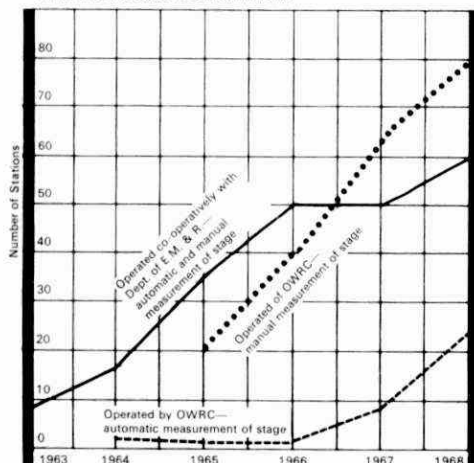
Measurements of streamflow were undertaken during the summer months on a number of water-courses not regularly gauged. Two hundred and twenty-one measurements were taken at 72 sites.

A short report on "Streamflows in the Kettle Creek Watershed" was prepared for management.

A report entitled "A Water Use Study of the Agnew Lake Area" was prepared for inter-divisional use in assessing waste disposal facilities for a proposed uranium mine and mill.

The draft report of the data for the Synoptic Water Resources Survey in Southern Ontario for the years 1965 to 1967 was still under review.

Fig. 6
Streamflow Gauging Stations Operated by the Branch or Maintained Co-operatively with the Federal Government.



International Hydrological Decade

The assessment of ground-water conditions in an overburden aquifer and in the Salina rock formation at Wainfleet, in the County of Welland, was in progress at the end of the year. This is a project carried out as part of the Commission's participation in the International Hydrological Decade program.

A paper entitled "Aquifer Test in a Sand Plain at Bothwell, Ontario," was published in volume 19 of the Proceedings of the Geological Association of Canada. Reports of work done at Colchester South, near Harrow, and in the Township of Sullivan were under preparation.

Northern Ontario Water Resources Studies

The collection of hydrological and geological data in the Hudson Bay drainage basins continued. Streamflows were measured regularly at 15 sites throughout the summer. Automatic water level recorders were installed and operated at 12 sites during the summer season. These records form a useful supplement to those obtained through the program operated in conjunction with the Federal Government. Under this program the Water Survey of Canada operates 21 recording streamflow gauges and five lake level gauges on a shared cost basis. In addition, the Branch shared the costs of equipping three manual stations with automatic recorders but it made no contributions towards their operation.

A recording rain-gauge was developed by the Branch and three installations were operated during the field season.

A total of 11 observation wells was installed during the year. Seven were constructed by the Branch. Four were bore holes drilled by the Federal Government for its engineering studies and were left

for the Commission's use by arrangement.

Two new snow courses were established at Nakina and Ogoki and brought the number operated by the Branch to six.

The upper part of the Winisk basin was mapped to complete the Pleistocene geological map that was under preparation.

A Water Resource Bulletin containing data collected since 1966 was under preparation and nearing completion.

Radiological Pollution Investigation

Eighteen streamflow gauging stations were operated in the Elliot Lake area and six in the Bancroft area in support of radiological pollution investigations. A cableway was constructed at one site to permit the measurement of high flows. Rating curves have been developed for 12 of the stations in Elliot Lake and 3 of the stations in Bancroft. Problems with the development of rating curves for a number of the stations were related to accessibility and the activities of beavers.

A water use study was conducted in the Elliot Lake area and a draft report of the findings was completed.

RIVER BASIN RESEARCH BRANCH

The activities of the River Basin Research Branch were concentrated on scientific hydrologic studies and these formed a large part of the Commission's contribution to the International Hydrological Decade program. Its specialized studies, such as soil analyses, electric well logging and geophysical surveys, were carried out in support of these and other programs of the Division. Under the International Field Year on the Great Lakes program, the Branch commenced its studies of ground-water inflow to Lake Ontario.

Representative Basin Studies

The study of hydrologic and hydrogeologic phenomena in five drainage basins representative of major geomorphologic regions in southern Ontario continued. This work is a contribution to the program of the International Hydrological Decade.

Table 7 shows a summary of the hydrometric stations operated by the Branch in its five representative basins. The number of manual observation wells was increased significantly to aid in ground-water flow studies; there was a modest increase in the number of soil moisture stations, and measurement of ground temperatures in one basin was initiated.

Blue Springs Creek

Studies in the Blue Springs Creek basin were being carried out in co-operation with the University of Guelph. The university continued its bi-monthly water quality sampling program at one automatic streamflow gauging station. The samples were analyzed by the OWRC laboratory.

Routine streamflow measurements were continued and nine sets of water samples were collected for chemical analyses.

General maintenance work was carried out and data collected from the observation wells previously installed in the basin. A network of eight existing shallow wells was established as a supplementary observation well system. A preliminary report was written on the geology of the basin.

The geophysical survey using seismic techniques was continued to determine the depths to bedrock in certain areas and to aid in the tracing of buried bedrock valleys.

Bowmanville, Soper and Wilmot Creeks

The streamflow stations were maintained and 13 sets of water samples were taken for chemical analyses. One spillway and two artificial concrete controls were constructed at automatic streamflow gauging stations. A preliminary hydrologic budget was established for the basin with concentrated

Table 7
Summary of Hydrometric Stations Operated by the River Basin Research Branch in Representative Basins

BASIN	METEOROLOGICAL STATIONS		SNOW COURSES	STREAMFLOW GAUGING STATIONS		OBSERVATION WELLS		SOIL MOISTURE STATIONS
	MAIN	SATELLITE		Recording	Manual	Recording	Manual	
Blue Springs Creek	—	—	—	—	5	5	19	
Bowmanville, Soper & Wilmot Creeks	2	17	12	12	2	11	37	17
East & Middle Oakville Creeks	1	8	—	4	—	2	25	—
Venison Creek	1	5	—	2	1	4	3	—
Wilton Creek	2	6	—	1	2	6	3	—
TOTALS	6	36	12	19	10	28	87	17

work on hydrograph separation.

General maintenance work was carried out and data collected from 24 observation wells, three of which were installed in 1968. Three gamma and two electric logs were obtained in the newly-installed observation wells to correlate geologic conditions in the basin. A network of 25 existing shallow wells was established for the collection of supplementary water-level data and two sets of measurements were taken. Detailed geologic studies were carried out and two maps were prepared showing depths to available ground-water supplies and probable aquifer yields.

Sieve analyses were carried out on 28 samples taken from geologic sections and during the drilling for observation wells in the basin. A preliminary investigation was carried out to trace ground-water movement by chemical analyses of well-water samples.

The soil moisture measurement network was completed in the Wilmot Creek sub-basin with the installation of 31 access tubes at 11 stations; two series of measurements were carried out and a preliminary analysis of data was commenced. Data from the land and water use survey previously completed were analyzed and a draft report was completed.

Five Sacramento precipitation storage gauges were measured by Branch members. Marking of snow measurement stations was commenced and twelve snow courses were operated in the Wilmot Creek sub-basin. One synoptic snow survey was carried out in the Bowmanville and the Soper creeks sub-basins. Evaluation and analysis of the 1966-67 and 1967-68 snow survey data were continued. Two ground-temperature recorders were installed at the Long Sault and the Bowmanville main climatological stations.

East and Middle Oakville Creeks

In conjunction with streamflow measurements, eight sets of water samples were taken for chemical analyses. Discharge data were compiled and plotted and work was commenced on streamflow hydrograph analysis.

General maintenance work was carried out and data collected at 12 observation wells, three of which were installed in 1968. A network of 15 existing shallow wells was established for the collection of supplementary water-level data. Gamma and electric logging were carried out in the three new observation wells.

The geophysical survey using electrical resistivity techniques was completed in order to provide ground resistivity control for the airborne resistivity survey undertaken in the area by the Geological Survey of Canada.

Eight snow courses were measured and preliminary data analyses were carried out.

A land and water use survey was completed through 1,056 personal interviews. A creek survey to delineate unmapped drainage features was carried out.

Venison Creek

Two manual streamflow stations were converted to automatic recording stations. Samples for chemical analyses were taken eight times in conjunction with streamflow measurements.

General maintenance work was carried out and data were collected and compiled from seven observation wells.

The land and water use in the basin was investigated through 270 interviews with residents of the area. A creek survey to delineate unmapped drainage features was completed.



Wilton Creek

Two manual streamflow stations were equipped with staff gauges and one automatic station, including an artificial control, was constructed. Seven sets of water samples were taken in conjunction with streamflow measurements. One staff gauge was installed near the mouth of the creek to study backwater effects of Lake Ontario on the nearby water-table. Data were collected from the one Sacramento precipitation storage gauge in the basin.

The installation of observation wells was completed with the drilling of the ninth well. Data were collected and compiled from these, and two wells were equipped with automatic recorders. Gamma and electric logging were carried out on the new well.

Reconnaissance mapping of the geology of the basin was carried out.

Special Geophysical Investigations

In addition to the geophysical surveys carried out in the representative basins, studies were undertaken in support of programs of other branches of the Division.

To assist in the interpretation of geologic sequences during test-drilling projects, gamma and electric logs were obtained in 11 wells for the Surveys and Projects Branch and in two wells for the Hydrologic Data Branch.

Seismic studies were carried out at Barry's Bay and seismic and electrical resistivity surveys were carried out at Vermilion Bay, Killaloe Station and Nakina (Northern Ontario Water Resources Survey) in support of test-drilling projects and geological surveys undertaken by the Surveys and Projects Branch.

Soils Laboratory Studies

In support of test-drilling projects and geological investigations, 67 sieve analyses were carried out on samples submitted by the Surveys and Projects Branch and six sieve and seven hydrometer analyses were completed for the Hydrologic Data Branch.

International Field Year on the Great Lakes

Under the International Hydrological Decade program, the International Field Year on the Great Lakes study was established. As part of the Commission's contribution to the study of ground-water inflow to Lake Ontario, several hydrogeologic provinces were established and detailed studies were begun in two representative areas, Forty Mile Creek and Wilmot Creek.

In the Forty Mile Creek basin, 21 abandoned wells were established as observation wells and two sets of measurements were completed. Water samples were taken for chemical analyses and preliminary conductivity readings were obtained. In preparation for a test-drilling program, the bed-rock geology was studied in detail and 12 hydrogeologic maps were prepared.

In the Wilmot Creek basin, preliminary investigations were made into its hydrogeologic aspects. Ground-water samples were taken for chemical analyses as an aid in the determination of ground-water flow patterns.

Ground-water and geology reconnaissance work was carried out in the Lake Ontario basin and areas of major overburden aquifers were outlined for approximately 30 per cent of the total area. A preliminary map showing bedrock-well yield was prepared for the Canadian side of the basin.



Members of the Branch were active on the Ground Water and the Soil Moisture sub-groups of the IFYGL Working Group on the Terrestrial Water Balance. A liason was maintained with the United States Geological Survey and the Federal Department of Energy, Mines and Resources, participating agencies in the program study.

Water-Well Records

Water-well records were prepared for automatic data processing for the IFYGL study. Assistance was received from the Cartographic Section of the Division in the modification of topographic maps, from the Water and Well Management Branch in the checking of well locations, and from the Inland Waters Branch of the Federal Department of Energy, Mines and Resources in the plotting and interpretation of elevations and co-ordinates. Approximately 35,000 well locations were plotted. The coding of well-record data was commenced and approximately 11,000 records were completed. Key punching and verification of the data were carried out by the Systems and EDP Branch of the Commission.

Appendix

Papers and Addresses by OWRC Personnel

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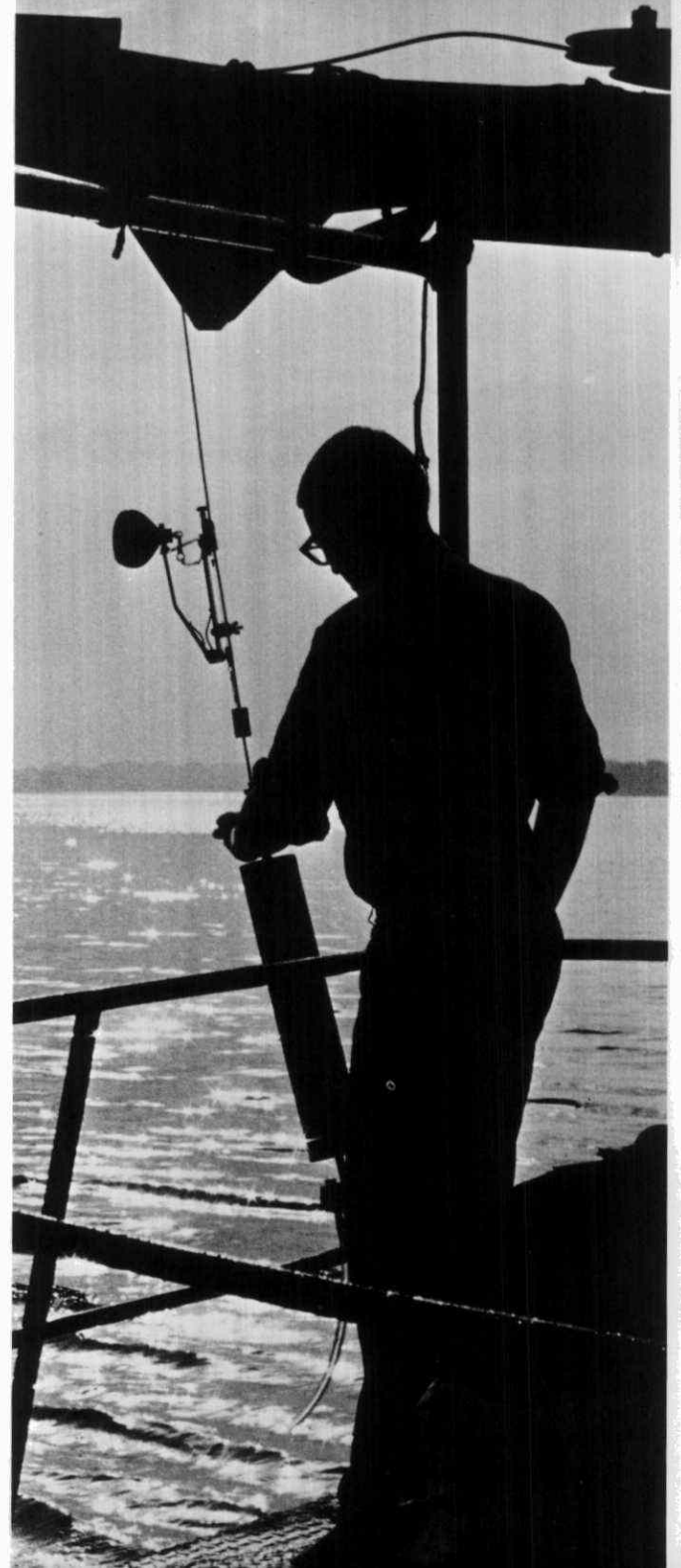
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